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ABSTRACT

An effort was undertaken to develop a job-oriented basic skills curriculum appropriate for the acoustic sensor operations area, which includes members of four ratings: ocean systems technician, aviation antisubmarine warfare operator, sonar technician (surface), and sonar technician (submarine). Analysis of the job duties of the four ratings revealed that sensor operations for acoustic analysis and continued on-the-job study are critical job requirements. The basic requirements for acoustic sensor operations consisted of skills in mathematics, reading, study skills, and memorization. The acoustic prerequisite requirements were skills in science, conceptual understanding of mechanical operations and relationships, and problem solving. Course objectives and instructional specifications were developed based upon the training requirements. (The seven-page narrative is followed by these appendixes: a sample job analysis survey; the basic skills survey; the acoustic prerequisite skills survey; terminal objectives and sample test items; and instructional specifications that detail, for each topic area, objectives, instructional media method, strategy specifications, instance specifications, and testing.) (YLB)

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# JOB-ORIENTED BASIC SKILLS (JOBS) PROGRAM FOR THE ACOUSTIC SENSOR OPERATIONS STRAND

Paula Kabance U'Ren
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Reviewed by
Edwin G. Aiken

U.S. DEPARTMENT OF EDUCATION
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The job-oriented basic skills (JOBS) program was conceived in 1977 to provide training courses for lower-aptitude Navy personnel that would enable them to complete Class "A" technical schools successfully. The purpose of the current effort is to develop a JOBS curriculum for the acoustic sensor operations area. Analyses conducted to ascertain job requirements and basic and prerequisite "A" school requirements showed

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that "A" school students need training in mathematics, reading, study skills, memorization, science, mechanical relationships, and problem solving. Instructional objectives and specifications based on these requirements were developed to provide a guideline for future curriculum development.

## FOREWORD

This research and development was conducted under task area Z1176-PN (Individual Technical Training), work unit Z1176-PN.03 (Improved Performance Through Instruction in "A" School-related Basic Skills). The purpose of this work unit is to develop a job-oriented basic skills (JOBS) program that will enable lower-aptitude students to complete "A" schools successfully. The purpose of the current effort is to develop a JOBS program for the ratings in the acoustic sensor operations area. This report describes the front-end instructional analysis and development of this effort. Future reports will describe curriculum development and program evaluation.

Three previous reports (NPRDC TRs 81-24, 82-14, and 83-5) described program development and evaluation for the ratings in the operations, administrative/clerical, electricity/electronics, and propulsion engineering areas.

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## SUMMARY

### Problem

In response to a widely predicted shortfall of high quality accessions in the 1980s, the job-oriented basic skills (JOBS) program was conceived in 1977 to compensate for skill deficits of lower aptitude personnel. During the last 5 years, prerequisite skill instructional material in four content areas was developed and evaluated. The JOBS potential for alleviating manpower shortages of technically trained personnel has encouraged the Navy to initiate development of JOBS programs in other content areas.

### Objective

The objective of the current effort is to develop a JOBS curriculum appropriate for the acoustic sensor operations area, which includes members in four ratings: ocean systems technician (OT), aviation antisubmarine warfare operator (AW), sonar technician, (surface) (STG), and sonar technician (submarine) (STS). The objective of the effort described herein was to ascertain job and basic/prerequisite "A" school requirements for these ratings.

### Approach

1. The OT, AW, STS, and STG ratings were job-analyzed to ascertain job requirements.

2. Basic and prerequisite skills analyses of the acoustic sensor operations class "A" schools were conducted to determine basic and prerequisite skills requirements.

### Finding and Conclusions

1. Analysis of AW, OT, STS, and STG job duties revealed that sensor operations for acoustic analysis and continued on-the-job study are critical job requirements.

2. The basic requirements for acoustic sensor operations consist of skills in mathematics, reading, study skills, and memorization.

3. The prerequisite requirements for the AW, OT, STS, and STG major "A" school topic areas are skills in science, conceptual understanding of mechanical operations and relationships, and problem solving.

4. Course objectives and instructional specifications were developed based upon the training requirements noted above.

### Recommendations

A JOBS curriculum in the acoustic sensor operations area should be developed based upon the objectives and instructional specifications presented herein.

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## INTRODUCTION

### Problem and Background

The job-oriented basic skills (JOBS) program was conceived in 1977 in response to the widely predicted shortfall in high-quality accessions during the 1980s. The purpose of the program is to compensate for skill deficits of lower-aptitude personnel through the implementation of a prerequisite skill instructional program that may enable these students to complete the Navy's technical schools successfully and help diminish the shortage of technically trained personnel. Curricula for four content areas were developed during 1979 and 1980 (Harding, Mogford, Melching, & Showel, 1981). Evaluation of JOBS program success thus far indicates that the program has the potential for attenuating Navy technical manpower shortages and contributing to minority upward mobility (Baker & Huff, 1981; Baker & Hamovitch, 1983).

In July 1982, the Chief of Naval Education and Training (CNET) requested the Navy Personnel Research and Development Center (NAVPERSRANDCEN) to develop a JOBS curriculum appropriate for the acoustic sensor operations area, which includes members of four ratings: ocean systems technician (OT), aviation antisubmarine warfare operator (AW), sonar technician (surface) (STG), and sonar technician (submarine) (STS). Although members of these ratings all operate, analyze, and interpret data displayed on acoustic processing systems, they accomplish these responsibilities from different perspectives. OTs operate at shore-based naval facilities (NAVFACS), STGs and STSs conduct operations on board their respective ships, and AWs operate from land and sea-based aircraft.

### Purpose

The objective of this effort was to conduct the front-end instructional analysis necessary to develop a JOBS curriculum for the acoustic sensor operations area.

## APPROACH

### Job Analysis

Jobs performed by members of the four acoustic sensor operations ratings were analyzed to determine their extent of commonality and to ascertain the scope and importance of each. In addition, since it had been reported that OTs were successfully completing OT "A" School but later showed deficiencies on-the-job, the job analysis was also used to identify job requirements not covered in "A" school that could be addressed in the JOBS program.

During August and September of 1982, NAVPERSRANDCEN personnel interviewed and administered a job analysis survey to AW, OT, STG, and STS E-4s through E-7s assigned to the Navy Oceanographic Processing Facility; the Fleet Anti-Submarine Warfare Training Center, Pacific; or the Anti-Submarine Warfare Wing, Pacific. Since personnel assigned to the latter two activities included those currently performing shore-based duties (e.g., instructors), all respondents were requested to answer the survey as if they were under deployed conditions.

The job analysis survey consisted of items extracted from the required skills for E-4s to E-7s in the targeted ratings listed in Section I of the Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards (NAVPERS 18068D).

Participants were asked to rate each task on its level of importance and the percent of time spent performing the task. (Appendix A contains a sample of the survey used.)

Using descriptive statistics, analyses were conducted on the survey data for each rating. Table 1, which presents the job duties rated as critical by 70 percent or more of the respondents, shows that each rating has important job duties distinctive to its particular community. For example, AWs are responsible for general flight crew duties; and STGs, for both sonar equipment operation and repair responsibilities. Table 1 also reveals that OTs, STGs, and STSs rate detection and classification (sensor operations) as one of the more critical aspects of their jobs. However, small-group interviews, conducted after the surveys were completed, revealed that members of all four ratings regard sensor operation for acoustic analysis as their first priority. The reason for the discrepancy between AW survey and interview results, as explained by AWs from the helicopter community, is that, when they are deployed, much of their time is spent on search and rescue and other utility functions. This would account for the fact that job tasks involving sensor operations (i.e., detect, classify, and report sonar contacts and detect submarine evasive maneuvers) were rated as critical by only 62 percent of the AWs. In fact, the operation of sonar sensors to detect and classify contacts is an area of commonality across OT, STG, STS, and AW and is a critical aspect of their job responsibilities.

The interviews also provided the opportunity to obtain an estimate of basic skill needs and additional job requirements. Interviewees discussed observed deficiencies in the areas of mathematics, notetaking, general study skills, reading ability, and memorization. One of the job requirements mentioned concerns the maintenance of vigilance while monitoring acoustic processing systems during watch periods. Another is studying technical and intelligence publications to enable personnel to to increase their experience and remain current in their field. An on-the-job learning process necessitating continuous independent study may require additional learning skills.

Basic and Prerequisite Skills Analyses

To determine the basic and prerequisite requirements of the acoustic sensor operations "A" schools, instructors of OT, AW, STS, and STG "A" and common core schools were interviewed using two surveys developed for use in small-group or individual interviews. The Basic Skills Survey, which was designed to elicit specific basic skill needs, consisted of explicit questions concerning basic skill deficiencies mentioned during the job analysis interviews. The Acoustic Prerequisite Skills Survey (APSS), which was designed to determine prerequisite requirements for acoustic detection and classification, was constructed by examining OT, AW, STG, and STS "A" school instructor and student guides. The major topic areas were extracted for each rating and those taught in all four ratings were included on the survey. A comparison of the final list of APSS topics with a commonality analysis conducted across acoustic platforms (airborne, submarine, and surface) (Robinson, Smith, & Thode, 1982) showed that the two concurred on the common subject matter that is taught among the acoustic communities. The APSS topics also agree with the detection and classification commonality revealed by the job analysis discussed previously. (Copies of the surveys are included in Appendices B and C.)

During the period between September and December 1982, interviews were conducted with (1) three common-core instructors from the Anti-Submarine Warfare Wing, Pacific, (2) four "A" school instructors from the Fleet Anti-Submarine Warfare Training Facility, Pacific, and (3) six "A" school instructors from the Fleet Anti-Submarine Warfare Training Facility, Atlantic. After the instructors were informed of the general background of the

Table 1

Job Tasks Rated as Critical in Importance by 70 Percent or More of Survey Respondents

| AW | OT | STG | STS |
|---|---|---|---|
| *Perform pre and post flight inspections | *Perform analysis and classifications | *Operate sonar sensors: detect and classify | *Operate sonar sensors: detect and classify |
| Perform flight checks on survival equipment | *Determine target bearing | *Stand sonar watch | Report and record contacts |
| *Communicate on ICS circuits | Maintain plots and status boards | Conduct urgent ASW attack | *Stand sonar watch |
| Instruct personnel on tactical use of airborne ASW equipment | *Interpret operational messages | Evaluate contact information and make tactical recommendations | Determine contact position |
| Instruct personnel in aircrew duties | Evaluate acoustic intelligence | Localize electronic equipment casualties | Analyze lofar contacts |
| *Supervise pre, post, and in-flight operation checks | Establish probability areas | *Supervise maintenance and repair of sonar equipment | Maintain, troubleshoot, and repair sonar equipment |
| | *Determine contact position | *Evaluate operational tests of ASW equipment | Determine optimum mode of sonar operation |
| | Coordinate use of ancillary equipment | Train, drill, and supervise A/S teams | |

Note. Personnel indicated they spent the highest percentage of their time on these tasks marked by an asterisk.

JOBS program and the purpose of the interviews, they were provided with a copy of both surveys to facilitate discussion and to structure the interview session. Survey topics were discussed one at a time and all responses, whether reached by group consensus or contributed individually, were recorded during the interview by the experimenter. Each interview session required approximately 1.5 hours.

## RESULTS

### Basic Skill Requirements

Basic skill survey results indicate that entering "A" school students need some level of proficiency in the following areas:

1. Mathematics. This includes training in (a) making decisions concerning when to use subtraction, addition, multiplication, and division, (b) adding and subtracting negative numbers, (c) understanding percentages and the relationship between percents and decimals, (d) understanding ratios, and (e) working with equations or formulas. Requirements for knowledge of equations/formulas can be separated into three areas: (a) how to form an equation/formula, (b) how to transpose an equation/formula, and (c) how to solve linked equation/formulas (e.g., the answer from formula #1 is needed to solve formula #2). Since calculators are used in "A" school, performing basic computations by hand is not a requirement; however, knowing how to enter percentage values into the calculator may be.

2. Reading. The requirement for reading technical manuals has been alleviated to a large extent by the heavy "A" school emphasis placed on instructor lectures, notetaking, and studying from student notes. Although publication research and reading is necessary on-the-job, it is not required in the "A" schools.

3. Study skills. Notetaking and studying are major requirements in all four "A" schools. Since class notes are the main source of study and reference, students need to be effective notetakers. After-class study is highly recommended by instructors. However, since all classified material, including student notes on that material, must remain at the school house, student study time is restricted, making efficient study methods even more important. Understanding charts and/or graphs designed to be used as study aids is also a requirement.

4. Memorization. Students need to be able to memorize formulas and technical terms, including a preponderance of technical terms with the same meaning (propeller shaft, prop shaft, PS, SR).

### Prerequisite Skill Requirements

Group discussions of the APSS topics revealed the following acoustic skill prerequisites:

1. Science. Students need to understand motion; sound generation and travel; effect of sound mediums on sound travel, wave patterns, and wavelengths; how to read scientific charts and graphs; and the structure of the ocean.

2. Conceptual understanding of mechanical operations and relationships. Students need to understand the basics of certain mechanical operations such as those involved in diesel, gas or turbine engines, drive shaft, and gear reduction, as well as the interrelationship of different parts of an engine.

3. Problem-solving techniques. These requirements encompass the ability to organize, categorize, and analyze a large quantity of very detailed and specific information.

Course Objectives

Based on the training requirements revealed by the basic and prerequisite skills analyses, course objectives and sample test items were developed for the acoustic sensor operations JOBS strand. Table 2 presents a summary of the objectives. (Appendix D containes copies of the objectives and sample test items.)

Table 2

Summary of Objectives for the Acoustic Sensor Operations JOBS Strand

| Topic Area | | Objective Title |
|---|---|---|
| Mathematics | 1.0 | Adding and subtracting negative numbers |
| | 2.0 | Converting decimals and percentages |
| | 3.0 | Expressing ratios |
| | 4.0 | Formulating word problems |
| | 5.0 | Transposing formulas |
| | 6.0 | Solving word problems |
| Study Skills | 1.0 | Notetaking |
| | 2.0 | Memorization |
| | 3.0 | Reading comprehension |
| | 4.0 | Concentration management |
| Mechanical Operations and Relationships | 1.0 | Engines--diesel/gas |
| | 2.0 | Identifying mechanical parts |
| | 3.0 | Functions of mechanical parts |
| | 4.0 | Gearing mechanisms |
| | 5.0 | Turbines |
| | 6.0 | Mechanical relationships |
| Science | 1.0 | Production of sound |
| | 2.0 | Sound generation |
| | 3.0 | Sound wavelength |
| | 4.0 | Sound propagation and media |
| | 5.0 | Sound propagation--terms |
| | 6.0 | Charts and graphs |
| | 7.0 | Graph design |
| | 8.0 | Structure of the ocean |
| Problem Solving | 1.0 | Five-step problem-solving method |
| | 2.0 | Tree diagram problem solving |
| | 3.0 | Vigilance |

Instructional Specifications

Based upon the course objectives and the basic and prerequisite requirements, instructional specifications were developed for each of the terminal objectives. These specifications, which were designed to provide guidelines for curriculum development and classroom instruction, are contained in Appendix E.

## RECOMMENDATIONS

It is recommended that a JOBS curriculum in the acoustic sensor operations area be developed based upon the objectives and instructional specifications presented herein.

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*Cited in Appendix E only.

# APPENDIX A

# EXAMPLE OF JOB ANALYSIS SURVEY

AVIATION ANTISUBMARINE WARFARE OPERATOR

(AW)

JOB ANALYSIS SURVEY

PROTECTION OF INDIVIDUAL PRIVACY

Under the authority of 57SC301, as reflected in OPNAV Notice 5450 of 17 April 1975, information is requested regarding your personal opinions and attitudes. The information will be used for statistical purposes only. In no case will the individual's responses be used in making decisions affecting Navy careers. You are not required to provide this information; your participation is voluntary.

| PART 1 | PART 2 |
|---|---|
| WHAT IMPORTANCE RATING WOULD YOU ASSIGN THIS TASK? | WHAT PERCENTAGE OF YOUR TIME IS SPENT PERFORMING THIS TASK? |
| (1) VERY LOW<br>(2) MODERATELY LOW<br>(3) MEDIUM<br>(4) MODERATELY HIGH<br>(5) CRITICAL | (1) NONE<br>(2) 5% to 25%<br>(3) 26% to 50%<br>(4) 51% to 75%<br>(5) 76% to 100% |

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) THIRD CLASS (AW3)

SENSOR OPERATIONS

1. DETECT, ANALYZE, CLASSIFY AND REPORT SONOBUOY GENERATED ACOUSTIC DATA
2. ANALYZE AIRBORNE BATHYTHERMOGRAPH RECORDINGS
3. IDENTIFY RF INTERFERENCE USING AURAL/ACOUSTIC EQUIPMENT
4. PERFORM ACOUSTIC TARGET FIXING
5. DETECT, CLASSIFY AND REPORT SONAR CONTACTS
6. IDENTIFY SOUNDS PRODUCED BY OWN EQUIPMENT, EVASION DEVICES, MARINE LIFE AND OTHER NATURAL PHENOMENA
7. OBTAIN AND CLASSIFY AURAL TURN COUNTS
8. ANNOTATE GRAMS, CHARTS AND MAGNETIC TAPES
9. ANALYZE DOPPLER INFORMATION
10. START, OPERATE AND ADJUST AIRBORNE ACOUSTIC SYSTEMS
11. DETERMINE ACOUSTIC ENERGY PROPAGATION CHARACTERISTICS UNDER VARIOUS OCEANOGRAPHIC CONDITIONS
12. VERIFY AND HANDLE AIRBORNE ASW SEARCH STORES AND ORDNANCE
13. STORE AND HANDLE AIRCRAFT MAGNETIC RECORDING TAPE
14. PERFORM AIRBORNE DATA LINK OPERATIONS

ADMINISTRATION

15. COMPLETE ASW EQUIPMENT LOGS AND RECORDS

MAINTENANCE PLANNING AND QUALITY ASSURANCE

16. PREPARE AIRCRAFT ASW SENSOR STATION DISCREPANCIES FOR MAINTENANCE ACTION
17. PERFORM PREFLIGHT, POSTFLIGHT AND INFLIGHT OPERATIONAL CHECKS ON AIRBORNE ACOUSTIC SYSTEMS
18. PERFORM PREFLIGHT AND POSTFLIGHT INSPECTIONS
19. PERFORM PREFLIGHT CHECKS ON SURVIVAL EQUIPMENT

| PART I | PART 2 |
|---|---|
| WHAT IMPORTANCE RATING WOULD YOU ASSIGN THIS TASK? | WHAT PERCENTAGE OF YOUR TIME IS SPENT PERFORMING THIS TASK? |
| (1) VERY LOW | (1) NONE |
| (2) MODERATELY LOW | (2) 5% to 25% |
| (3) MEDIUM | (3) 26% to 50% |
| (4) MODERATELY HIGH | (4) 51% to 75% |
| (5) CRITICAL | (5) 76% to 100% |

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) THIRD CLASS (AW3) con't

20. COMMUNICATE ON ICS AND TACTICAL CIRCUITS

ATTENTION!!!

AW3--PROCEED TO QUESTION 47
AW2--PROCEED TO QUESTION 21
AW1--PROCEED TO QUESTION 21

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) SECOND CLASS (AW2)

SENSOR OPERATOR

21. DETECT SUBMARINE EVASIVE MANEUVERS
22. PERFORM INFLIGHT DETECTION AND CLASSIFICATION OF AURAL AND ACOUSTIC DATA FROM MULTISOURCE TARGETS
23. PERFORM INFLIGHT DETECTION AND CLASSIFICATION OF AURAL AND ACOUSTIC DATA IN MULTITARGET ENVIRONMENT
24. ANALYZE ACOUSTIC SIGNATURES TO DETERMINE TARGET PROPULSION MODE, DEPTH AND SPEED OF ADVANCE
25. DETERMINE AURALLY ASSOCIATED EQUIPMENT NOISES FROM TARGETS SURFACED AND SUBMERGED
26. PLOT ASW DATA FOR RECONSTRUCTION

ADMINISTRATION

27. MAINTAIN TAPE SIGNATURE LIBRARY
28. MAINTAIN RECORDS OF ASW SEARCH STORE EXPENDITURES

PUBLICATIONS

29. RESEARCH ASW INFORMATION AND INTELLIGENCE PUBLICATIONS

MAINTENANCE PLANNING AND QUALITY ASSURANCE

30. PERFORM PREFLIGHT, INFLIGHT AND POSTFLIGHT DIAGNOSTIC FUNCTIONS TO FAULT ISOLATE TO A LINE REPLACEABLE ASSEMBLY ON AIRCRAFT EQUIPMENT

| PART I | PART 2 |
|---|---|
| WHAT IMPORTANCE RATING WOULD YOU ASSIGN THIS TASK? | WHAT PERCENTAGE OF YOUR TIME IS SPENT PERFORMING THIS TASK? |
| (1) VERY LOW<br>(2) MODERATELY LOW<br>(3) MEDIUM<br>(4) MODERATELY HIGH<br>(5) CRITICAL | (1) NONE<br>(2) 5% to 25%<br>(3) 26% to 50%<br>(4) 51% to 75%<br>(5) 76% to 100% |

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) SECOND CLASS (AW2) con't

TACTICS

31. ANALYZE ENVIRONMENTAL DATA AND IMPLEMENT SENSOR STATION TACTICAL PROCEDURES

ATTENTION!!!

AW2--PROCEED TO QUESTION 47
AW1--PROCEED TO QUESTION 32

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) FIRST CLASS (AW1)

SENSOR OPERATIONS

32. PERFORM RECONSTRUCTION OF AIRBORNE ASW EXERCISES
33. DETERMINE TARGET DEPTH AND SPEED USING POSTFLIGHT ANALYSIS TECHNIQUES
34. PERFORM RADAR NAVIGATION
35. PERFORM AURAL AND ACOUSTIC POSTFLIGHT ANALYSIS ON A MULTISOURCE TARGET
36. PERFORM AURAL AND ACOUSTIC POSTFLIGHT ANALYSIS IN A MULTITARGET ENVIRONMENT
37. STORE AND RETRIEVE AIRBORNE ASW DATA

TRAINING

38. MAINTAIN AIRBORNE ASW OPERATOR TRAINING RECORDS
39. INSTRUCT PERSONNEL IN THE USE OF ASW TACTICAL AND INTELLIGENCE PUBLICATIONS
40. INSTRUCT PERSONNEL IN THE TACTICAL USE OF AIRBORNE ASW EQUIPMENT
41. INSTRUCT PERSONNEL IN AIRCREW DUTIES

| PART I | PART 2 |
|---|---|
| WHAT IMPORTANCE RATING WOULD YOU ASSIGN THIS TASK? | WHAT PERCENTAGE OF YOUR TIME IS SPENT PERFORMING THIS TASK? |
| (1) VERY LOW<br>(2) MODERATELY LOW<br>(3) MEDIUM<br>(4) MODERATELY HIGH<br>(5) CRITICAL | (1) NONE<br>(2) 5% to 25%<br>(3) 26% to 50%<br>(4) 51% to 75%<br>(5) 76% to 100% |

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) SECOND CLASS (AW2) con't

TACTICS

31. ANALYZE ENVIRONMENTAL DATA AND IMPLEMENT SENSOR STATION TACTICAL PROCEDURES

ATTENTION!!!

AW2--PROCEED TO QUESTION 47
AW1--PROCEED TO QUESTION 32

AVIATION ANTISUBMARINE WARFARE OPERATOR (ACOUSTIC) FIRST CLASS (AW1)

SENSOR OPERATIONS

32. PERFORM RECONSTRUCTION OF AIRBORNE ASW EXERCISES
33. DETERMINE TARGET DEPTH AND SPEED USING POSTFLIGHT ANALYSIS TECHNIQUES
34. PERFORM RADAR NAVIGATION
35. PERFORM AURAL AND ACOUSTIC POSTFLIGHT ANALYSIS ON A MULTISOURCE TARGET
36. PERFORM AURAL AND ACOUSTIC POSTFLIGHT ANALYSIS IN A MULTITARGET ENVIRONMENT
37. STORE AND RETRIEVE AIRBORNE ASW DATA

TRAINING

38. MAINTAIN AIRBORNE ASW OPERATOR TRAINING RECORDS
39. INSTRUCT PERSONNEL IN THE USE OF ASW TACTICAL AND INTELLIGENCE PUBLICATIONS
40. INSTRUCT PERSONNEL IN THE TACTICAL USE OF AIRBORNE ASW EQUIPMENT
41. INSTRUCT PERSONNEL IN AIRCREW DUTIES

| PART 1 | PART 2 |
|---|---|
| WHAT IMPORTANCE RATING WOULD YOU ASSIGN THIS TASK? | WHAT PERCENTAGE OF YOUR TIME IS SPENT PERFORMING THIS TASK? |
| (1) VERY LOW<br>(2) MODERATELY LOW<br>(3) MEDIUM<br>(4) MODERATELY HIGH<br>(5) CRITICAL | (1) NONE<br>(2) 5% to 25%<br>(3) 26% to 50%<br>(4) 51% to 75%<br>(5) 76% to 100% |

AVIATION ANTISUBMARINE WARFARE OPERATIONS (ACOUSTIC) FIRST CLASS (AW1) con't

MAINTENANCE PLANNING AND QUALITY ASSURANCE

42. SUPERVISE PREFLIGHT, POSTFLIGHT AND INFLIGHT OPERATIONAL CHECKS

43. MONITOR PREFLIGHT, INFLIGHT AND POSTFLIGHT DIAGNOSTIC FUNCTIONS TO FAULT ISOLATE TO A LINE REPLACEABLE ASSEMBLY

44. SUPERVISE AIRCRAFT GROUND INSPECTIONS

TACTICS

45. PERFORM RECONSTRUCTION OF TARGET DATA

46. PREPARE AND INTERPRET ASW FORMATTED MESSAGES

PART 1--AW1 PROCEED TO #47
PART 2--END OF SURVEY

OTHER

47. HAVE YOU ATTENDED "A" SCHOOL? (1) YES (2) NO

48. DO YOU HAVE AN NEC FOR YOUR CURRENT JOB? (1) YES (2) NO

49. HOW LONG HAVE YOU BEEN IN YOUR CURRENT POSITION?

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 1-5 MONTHS | 6-11 MONTHS | 1-2 YEARS | OVER 2 YEARS |

50. WHAT IS YOUR PAYGRADE?

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| E-1 | E-2 | E-3 | E-4 | E-5 OR HIGHER |

BEGIN PART 2

# APPENDIX B

# BASIC SKILLS SURVEY

## BASIC SKILLS SURVEY

Area: Mathematics

1. Do students experience difficulty with:

   a. Addition, subtraction, multiplication, division?
   b. Simple equations?
   c. Solving formulas?
   d. Translating problems into equations?

2. What equations or types of equations are the most difficult for students to solve?

3. Are students required to use any of the following:

   Geometry?
   Fractions?
   Decimals?
   Ratios?
   Percentages?

4. With which of the math topic areas listed in question 3 do students experience difficulty?

5. Are students allowed to use calculators in school?

6. Do they know how to use calculators? (If no, list problems you have experienced.)

Area: Reading

1. Do students experience difficulty with: (provide examples)

   a. Simple sentence decoding?
   b. Basic vocabulary?
   c. Technical vocabulary?
   d. Decoding technical material?
   e. Searching publications for specific formulas or intelligence information?

2. Would a concise vocabulary and/or acronym list help the students to decode technical material more effectively?

Area: Study Skills

1. How many hours are students required to spend studying?

2. Are the students provided with in-class study time?

3. Are students provided with study areas (i.e., study hall)?

4. What type of notetaking format do the students use?

5. Do the students prefer to study from their notes or their textbook?

6. Do students use their notes or their textbook as a reference when they seek information to solve a problem?

7. When students seek information, do they use their text or the instructor as a resource?

8. Are the students given study skills training in "A" school? (If yes, describe the training briefly and the results.)

Area: Vocabulary and Memorization

1. How is technical vocabulary usually taught?

2. What percentage of the terms are students required to memorize?

3. Are the students required to accomplish term learning on their own?

4. What percentage of a student's training requires memorization?

5. What type of material are the students required to memorize? (i.e., technical terms, formulas)

6. Are memorization strategies taught in the classroom?

Area: Classification or Analysis

1. Can you identify specific problem areas that students have during the classification process?

2. What phase of analysis is the most difficult for students to grasp?

# APPENDIX C

# ACOUSTIC PREREQUISITE SKILLS SURVEY

## ACOUSTIC PREREQUISITE SKILLS SURVEY

1. Discuss prerequisites for the following sound propagation topics:

   a. Velocity of sound.
   b. Sound propagation paths (ray path plotting).
   c. Frequency and harmonics.

2. Topics a through f are important elements of lofargram analysis. Discuss the prerequisites for each topic.

   a. Diesel engines.
   b. Turbines.
   c. Propellers and prop shafts.
   d. Drive system.
   e. Auxiliaries.
   f. Artifacts.

3. Discuss the prerequisites for classification techniques such as the five-step method, Beta, and elimination techniques.

4. Discuss the prerequisites for active and passive tracking techniques.

## APPENDIX D

## TERMINAL OBJECTIVES AND SAMPLE TEST ITEMS


| Area | Page |
|---|---|
| Mathematics | D-1 |
| Study Skills | D-9 |
| Science | D-15 |
| Mechanical Operations and Relationships | D-27 |
| Problem Solving | D-35 |

MATHEMATICS

Adding and Subtracting Negative Numbers

OBJECTIVE 1.0 Given a set of mathematical problems, be able to add and subtract negative numbers (without a calculator). The standard is 90%.

SAMPLE TEST ITEMS:

Add the following negative numbers.

1. $$\begin{array}{r} -13 \\ +\ (-15) \\ \hline \end{array}$$

2. $(-7) + (-42) + (-51) =$

3. $(-16) + (-33) =$

4. $$\begin{array}{r} -13 \\ -22 \\ +(-51) \\ \hline \end{array}$$

Subtract the following negative numbers.

5. $(-7) - (-3) =$

6. $$\begin{array}{r} +21 \\ -(-21) \\ \hline \end{array}$$

7. $$\begin{array}{r} -36 \\ -(-13) \\ \hline \end{array}$$

8. $$\begin{array}{r} -2 \\ -(-15) \\ \hline \end{array}$$

## Converting Decimals & Percentages

OBJECTIVE 2.0 Given a list of numbers expressed as decimals or percentages, convert the decimal numbers into percentages and the percentages into decimal numbers with 90% accuracy.

SAMPLE TEST ITEMS:

Convert the following decimals to percentages.

1. .56=

2. 1.31=

3. .6 =

4. .02=

5. .003=

6. .811=

Convert the following percentages to decimals.

7. 95%=

8. .666%=

9. 200%-

10. 25.5% =

11. 6%=

12. 150.5%=

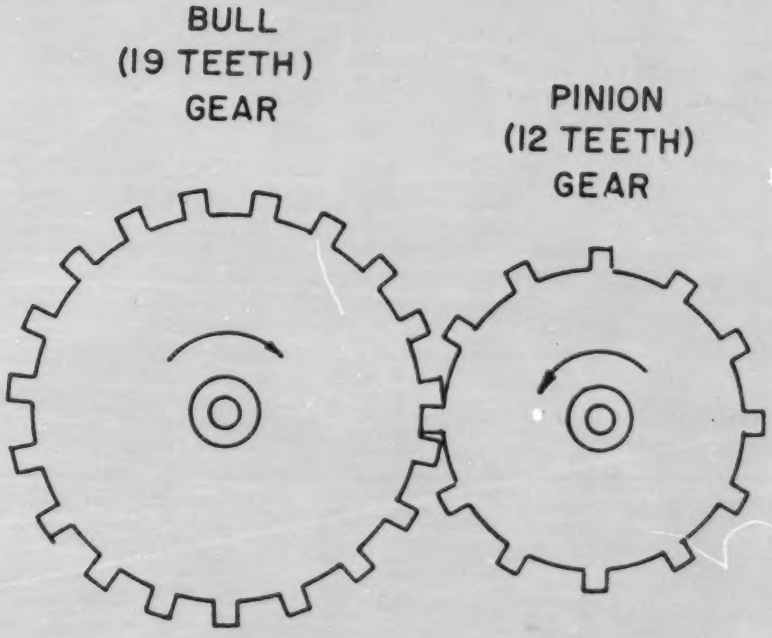
## Expressing Ratios

OBJECTIVE 3.0 Given two items to be compared, express the relationship between the items as a ratio and provide the solutions as a decimal value to the nearest 10th. The standard is 90%.

SAMPLE TEST ITEMS:

1. There are 210 girls and 115 boys attending Broadway Elementary School. What is the ratio of girls to boys?

2. Express the relationship between the Bull gear and the Pinion gear as a ratio.



## Formulating Word Problems

OBJECTIVE 4.0 Given word problems with one unknown value, be able to formulate an equation expressing the relationship stated in the word problem and then solve the equation for the unknown value. The standard is 90%.

SAMPLE TEST ITEMS:

1. A man drove 60 MPH to visit his friend. It took him 3 1/2 hours to get there. How many miles away does his friend live?

2. The cooling fan on an engine rotates twice as fast as the crankshaft. If the crankshaft is rotating at 3,000 RPMs, how many revolutions does the cooling fan make in 15 minutes?

3. A light is flashed on and off 200 times in 12 seconds. What is the frequency of the flash?

## Transposing Formulas

OBJECTIVE 5.0 Given various algebraic formulas, be able to transpose the formulas to solve for a requested value. The standard is 90%.

SAMPLE TEST ITEMS:

1. Solve for R

$$TD = \frac{L}{R}$$

2. Solve for L

$$f_{co} = \frac{R}{2\ L}$$

3. Solve for I

$$I^2 = \frac{P}{R}$$

4. Solve for f

$$\lambda = \frac{Y}{f}$$

5. Solve for $E_3$

$$E_1 = E_T - E_2 - E_3$$

6. Solve for I

$$P = I \times E$$

## Solving Word Problems

OBJECTIVE 6.0 Given a word problem that requires the manipulation of two formulas, be able to solve both formulas to obtain the problem's solution. The criterion is 90%.

SAMPLE TEST ITEMS:

1. If a car's tire is 3 feet in diameter and completes 560 revolutions in one minute (RPM), what is the speed of the car? (answer in miles per hour, MPH)

Formulas: $C = \pi D$ ($\pi = 3.14$)

$S = C \times RPM$

C=Circumference

D=Diameter

S=Speed

## ANSWERS TO THE SAMPLE TEST ITEMS

| OBJECTIVE | SAMPLE TEST ITEM | ANSWER |
|---|---|---|
| 1.0 | 1 | -28 |
| | 2 | -100 |
| | 3 | -49 |
| | 4 | -86 |
| | 5 | -4 |
| | 6 | 42 |
| | 7 | -23 |
| | 8 | 13 |
| 2.0 | 1 | 56% |
| | 2 | 131% |
| | 3 | 60% |
| | 4 | 2% |
| | 5 | .3% |
| | 6 | 81.1% |
| | 7 | .95 |
| | 8 | .00666 |
| | 9 | 2.0 |
| | 10 | .255 |
| | 11 | .06 |
| | 12 | 1.505 |
| 3.0 | 1 | 2:1 = 2 |
| | 2 | 19:12 = 1.58 |

| OBJECTIVE | SAMPLE TEST ITEM | ANSWER |
|---|---|---|
| 4.0 | 1 | D=S X T<br>D=60X3.5<br>D=210 |
| | 2 | R=(RPM X M) X 2<br>R=(3000X.25) X 2<br>R=1500 |
| | 3 | FPM=(200 X R) R=60÷12 ; R=5<br>FPM=200 X 5<br>FPM=1000 |
| 5.0 | 1 | $R=\frac{L}{TD}$ |
| | 2 | $L=\frac{R}{2\pi F_{co}}$ |
| | 3 | $I=\sqrt{\frac{P}{R}}$ |
| | 4 | $f=\frac{V}{\lambda}$ |
| | 5 | $E_3 = E_1 - E_2 - E_1$ |
| | 6 | $I=\frac{P}{E}$ |
| 6.0 | 1 | a) C=πD<br>C=3.14X3<br>C=9.42 ft/Rev<br>b) S=C X RPM<br>S=9.42 X 560<br>S=5275 ft/min |

OBJECTIVE 1.0 Given a written passage, the learner will demonstrate notetaking techniques by listing main and supporting ideas in an abbreviated format or using the networking strategy.

SAMPLE TEST ITEM:

Read and take notes on the passage below. Either list the main and supporting ideas in an abbreviated format, or use the networking strategy.

> Sound travels in the form of waves which may be classified as transverse or longitudinal. A transverse wave is one in which the particles of the medium through which the wave is passing move at right angles vertically to the wave's direction. In a longitudinal wave, the particles move back and forth along the wave's direction of travel, resulting in compression and rarefaction of the wave.

OBJECTIVE 2.0 The learner will be able to list the steps associated with each of the following mnemonic techniques: pegword, association chain, story and pattern.

SAMPLE TEST ITEM:

1. List the steps involved in using the association chain method to memorize material.

OBJECTIVE 3.0 The learner will be able to list the steps involved in the questioning and problem solving methods.

SAMPLE TEST ITEM:

1. List the steps involved in the questioning method.

OBJECTIVE 4.0 Given a scenario of a stressful situation, the learner will recommend and illustrate the use of either the self-talk or relaxation technique for creating a more positive mood.

SAMPLE TEST ITEM:

Read the following scenario. Using either the self-talk or relaxation technique, explain how Tom could create a more positive mood for studying.

Scenario

Tom is thinking about his father as he sits down to study. He is upset because of an arguement they have just had.

ANSWERS TO THE SAMPLE TEST ITEMS

OBJECTIVE 1.0 Using the main and supporting ideas strategy:

main idea: sound travels in waves

supporting ideas: transverse = particles move at right angles vertically

longitudinal: particles move back and forth resulting in compression and rarefaction

OBJECTIVE 2.0

1. List the mental associations that come to mind when you think about the material to be remembered.
2. Determine if any of the mental associations in step 1 lead you, by a chain of associations, to the material to be remembered.
3. Be sure that the association you formulated makes it possible to differentiate between other, similar material.
4. Write the mnemonic out for yourself to make the chain of associations clear.

OBJECTIVE 3.0

1. Read the paragraph and determine the main idea.
2. Make up a question that asks for an example of the main idea of the paragraph.
3. Learn the answer to the question you made up.

OBJECTIVE 4.0 Tom should talk to himself and resolve his conflict with his father in his mind, "I'm angry because I feel he didn't understand what I was trying to say. I need to express myself more clearly and calmly. Right now I have to study. I will pick a time later on and speak to Dad rationally. Right now I'll clear my mind and study".

SCIENCE

Production of Sound

OBJECTIVE 1.0 Given a short answer test, be able to list and define the three basic elements that are necessary before sound can be produced. The criterion is 100%.

SAMPLE TEST ITEM:

1. What three basic elements must be present before sound can be produced? List each element and give a brief definition.

## Sound Generation

OBJECTIVE 2.0 Using the tuning fork as an example, the student will write a short answer explanation of sound generation. The answer must contain motion/vibration, sound waves and medium.

SAMPLE TEST ITEM:

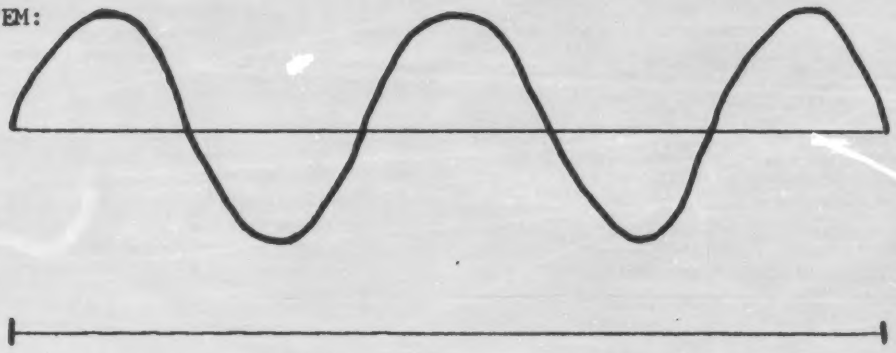
1. The tuning fork is one example of a sound source. Explain in 3 or 4 sentences the process of sound generation using a tuning fork.

## Sound Wavelengths

OBJECTIVE 3.0 Given a diagram of a wave pattern, be able to label parts of the diagram to illustrate cycle, wavelength, amplitude, and frequency. The criterion is 90% of the items labeled correctly.

SAMPLE TEST ITEM:

1.



Time = 1 Second

Sound Propagation & Mediums

OBJECTIVE 4.0 Given a short answer test, be able to answer questions on the relationship between sound mediums and sound propagation. The standard is 90%.

SAMPLE TEST ITEM:

1. A sound made in the ocean will travel _____ than a sound made in fresh water. (faster/slower)

2. A sound made at the surface of the ocean will _____ in speed as it approaches the ocean floor. increase/decrease

3. What will happen to a sound made under the surface of the ocean as it strikes a smooth ocean surface?

4. If a beam of sound in the ocean is traveling from a warm temperature near the surface to a cold temperature, 100 ft. below the surface, what will happen to the sound beam?

5. Will a sound travel faster on a clear night or a foggy night?

6. Will sound travel faster through water or metal?

7. What is the effect of ocean's temperature on the transmission of sound waves?

8. What effect does the ocean's salinity have on sound travel?

9. What effect does pressure have on the transmission of sound waves in the ocean?

## Sound Propagation - Terms

OBJECTIVE 5.0 Given a list of sound propagation terms and definitions, be able to match the term with the correct definition. The criterion is 90%.

SAMPLE TEST ITEM:

___1. reflection

___2. frequency

___3. velocity

___4. hertz

___5. refraction

___6. wavelength

a) a unit of frequency equal to one cycle per second

b) transmitted sound rays striking an abrupt surface and are returned at the same angle

c) a vector quantity including magnitude and direction in relation to a given frame of reference

d) the bending or curving of a sound ray when it passes from one sound velocity region to another

e) the distance between points of corresponding phase of two consecutive cycles

f) rate of vibration of a sound source

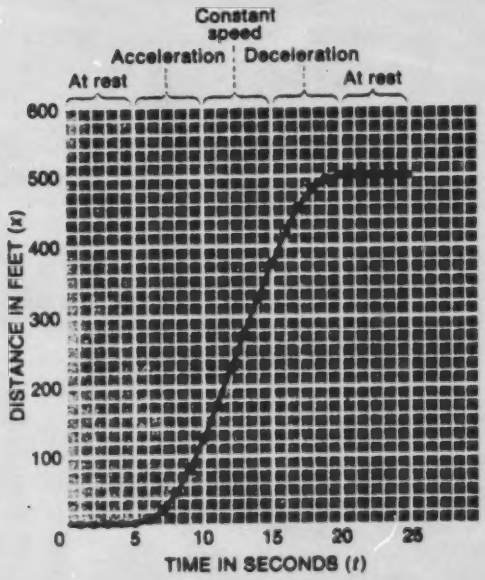
Graphs & Charts

OBJECTIVE 6.0 Given a graph or chart, be able to interpret the data displayed. The standard is 90%.

SAMPLE TEST ITEM:

FIGURE 1.

Car motion from start to stop




1. Approximately, how long did it take the car to travel 300 feet?

2. How far did the car travel between 10 and 20 seconds?

Table I Major Subdivisions of the Ocean

| Ocean | Area in sq.mi. | Mean depth in feet |
|---|---|---|
| Arctic | 5,427,000 | 5,010 |
| North Atlantic | 17,646,000 | 10,780 |
| South Atlantic | 14,098,000 | 13,420 |
| North Pacific | 31,639,000 | 14,050 |
| South Pacific | 32,361,000 | 12,660 |
| Indian | 28,400,000 | 13,002 |
| Southern (Antarctic) | 12,451,000 | 12,240 |

3. Which ocean has the smallest area?

4. Which ocean (or ocean area) is the deepest?

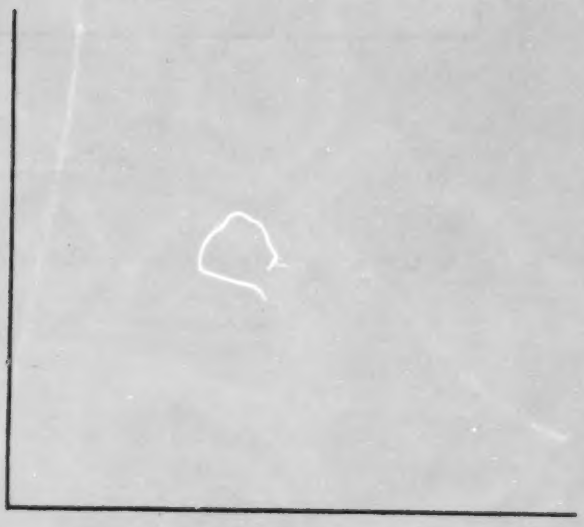
## Graph Design

OBJECTIVE 7.0 Given a blank graph showing an X and Y axis and a set of data, be able to label each axis and plot the data on the graph. The standard is 100% of the data plotted correctly.

SAMPLE TEST ITEM:

1.

| Depth (feet) | Temperature (°F) |
|---|---|
| surface | 68 |
| 5 | 65 |
| 10 | 62 |
| 15 | 58 |
| 20 | 55 |
| 25 | 50 |



## Structure of the Ocean

OBJECTIVE 8.0 Given a short-answer and multiple-choice test, be able to demonstrate knowledge of the structure of the ocean. The criterion is 90%.

SAMPLE TEST ITEM:

1. The continents are surrounded by a shallow submerged zone called a_____.

2. Canyons which cut across the continental shelf and down the continental slope are called_____.

3. _____are volcanic peaks that do not reach the surface of the ocean.

4. Which of the following has the deepest ocean trenches?

   A. Atlantic Ocean
   B. Pacific Ocean
   C. Arctic Ocean
   D. Indian Ocean

5. Which of the following is a longer distance from sea level?

   1. Mt. Everest
   2. Deep ocean area (Mariana's deep)

6. The ocean ridges were most likely formed by_____.

7. Most continental shelves consist of:

   1. Coral rock
   2. Stony, waterworn cobbles
   3. Lava
   4. Mud and Sand

OBJECTIVE 8.0 (cont.)

8. The total amount of dissolved salt in sea water is termed_____.

9. The density of sea water is determined by the _____, _____, and _____.

10. Ocean currents are a result of the combined effects of what two things?
_____, _____.

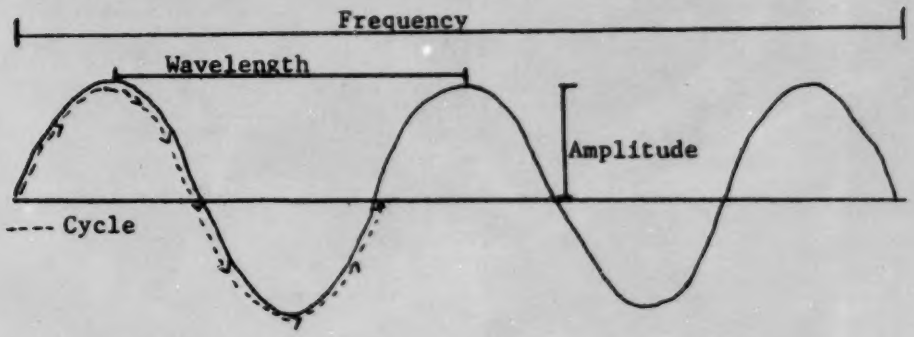
11. The temperature of the upper zone of the open ocean surface shows,
    1. constant stability
    2. seasonal variations
    3. no apparent pattern
    4. an increase in the Atlantic

## ANSWERS TO THE SAMPLE TEST ITEMS

OBJECTIVE 1.0 The three basic elements are: a source of sound, a medium to transmit the sound (e.g. air, water), and a detector to hear the sound (e.g. ear).

OBJECTIVE 2.0 After a tuning fork is struck it begins to vibrate back and forth. This motion generates sound waves through the air. When the sound waves are received by the human ear it 'sounds' like a tone.

OBJECTIVE 3.0




OBJECTIVE 4.0 Item 1: faster

Item 2: increase

Item 3: reflected towards the ocean bottom at an angle nearly equal to the angle of incidence (when it struck the surface).

Item 4: the sound beam will be refracted in a curved path toward the ocean bottom

Item 5: foggy night

Item 6: metal

Item 7: the speed of sound increases with increasing temperature

Item 8: an increase in the salinity will increase the speed of sound (the saltier the water the faster sound travels)

Item 9: sound travels faster as water pressure increases

OBJECTIVE 5.0 Item 1: b

Item 2: f

Item 3: c

Item 4: a

Item 5: d

Item 6: e

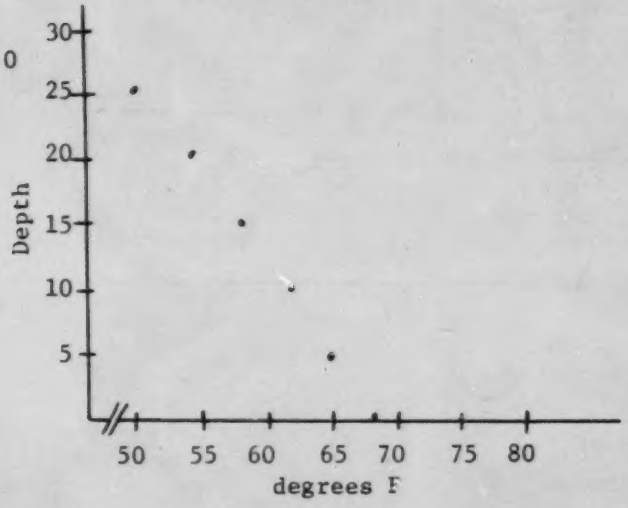
OBJECTIVE 6.0 Item 1: 13.5 seconds

Item 2: 480 feet

Item 3: Arctic

Item 4: North Pacific

OBJECTIVE 7.0




OBJECTIVE 8.0 Item 1: continental shelf

Item 2: submarine canyons

Item 3: sea mounts

Item 4: B

Item 5: 2

Item 6: volcanic action

Item 7: 4

Item 8: salinity

Item 9: temperature, salinity, and pressure

Item 10: thermohaline motions and wind motions

Item 11: 2

## MECHANICAL OPERATIONS AND RELATIONSHIPS

### Engine - Diesel/Gas

OBJECTIVE 1.0 Given a series of true/false statements concerning gas and diesel engines, the learner will determine whether each statement is true or false. The criterion is 90%.

SAMPLE TEST ITEMS:

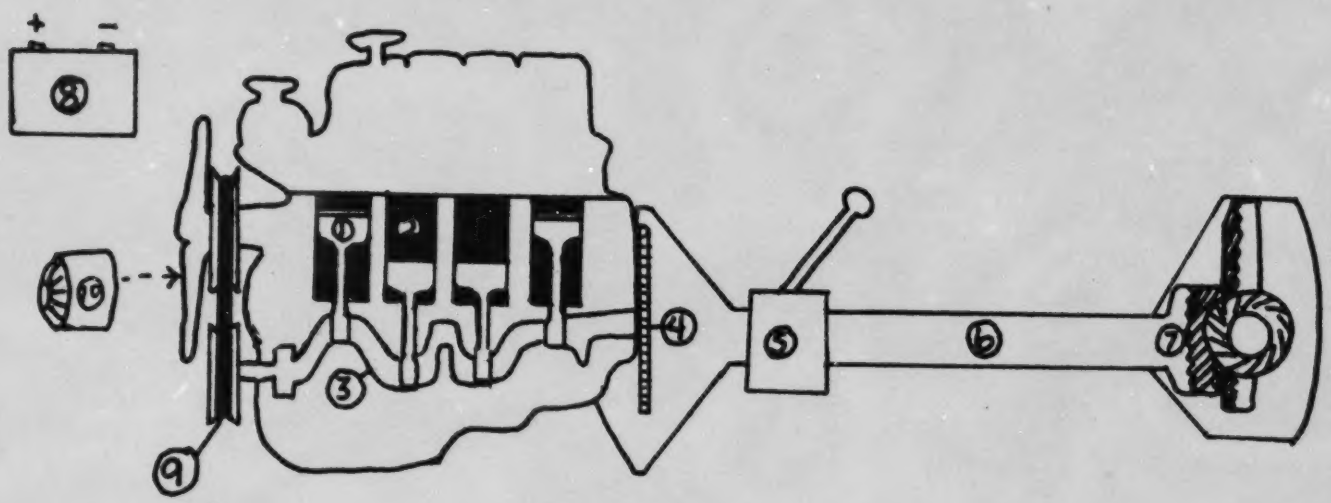
1. Spark plugs ignite fuel vapor in a diesel engine.

2. Generally speaking, gasoline engines are quieter than diesel engines.

Identifying Mechanical Parts

OBJECTIVE 2.0 Given a diagram of a car's engine, drive shaft, and electrical auxiliaries, the learner will label the following parts: Piston, Alternator, Cylinder, Crankshaft, Flywheel, Transmission, Fan-Belt, Drive shaft, Differential and Battery. The standard is 90%.

SAMPLE TEST ITEMS: Label each part according to its number on the diagram below.




1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

## Functions of Mechanical Parts

OBJECTIVE 3.0 Given a list of mechanical parts and a list of functions, the learner will match the part with its function. The standard is 90%.

SAMPLE TEST ITEMS: Match each part listed below with the function which it performs.

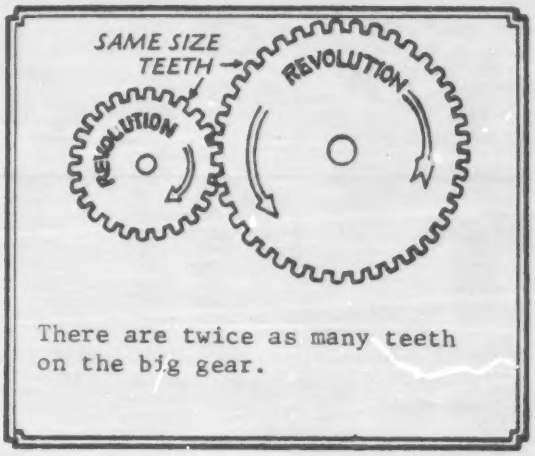
| | |
|---|---|
| _____1. Piston | A. Smooths out action of the pistons. |
| _____2. Crankshaft | B. Stores electrical energy |
| _____3. Cylinder | C. Allows wheels to turn independently |
| _____4. Battery | D. Replaces lost battery energy |
| _____5. Flywheel | E. Compresses fuel vapor into chamber and is thrust down by explosion |
| _____6. Differential | F. Chamber where explosion takes place |
| _____7. Alternator | G. Sends part of the engine's energy to the alternator |
| _____8. Drive Shaft | H. Carries power from the front of the car to the rear of the car |
| _____9. Transmission | I. Takes energy from the up-and-down movement of the pistons and changes it into a rotational force down the drive shaft |
| _____10. Fan belt | J. Changes gears |

## Gearing Mechanisms

OBJECTIVE 4.0 Given a short answer test, be able to answer questions on the function of gearing mechanisms and gear reduction. The standard is 90%.

SAMPLE TEST ITEM:

1.




How many times does the little gear turn in relation to the big gear?

2. What general mechanism translates the round and round movement of a car motor into the round and round movement of the wheels?

## Turbines

OBJECTIVE 5.0 The learner will briefly describe the operation of a turbine. Attributes required for full credit include: a. force coming in contact with blades, b. spinning action of blades, c. torque energy carried by turbine shaft.

SAMPLE TEST ITEM:

1. Briefly describe the operation of a turbine. Include sketches if necessary.

## Mechanical Relationships

OBJECTIVE 6.0 Given a list of mechanical parts to be able to identify which of the following categories it belongs to: prime mover, drive or gearing system, propulsion system, or auxiliary.

SAMPLE TEST ITEM:

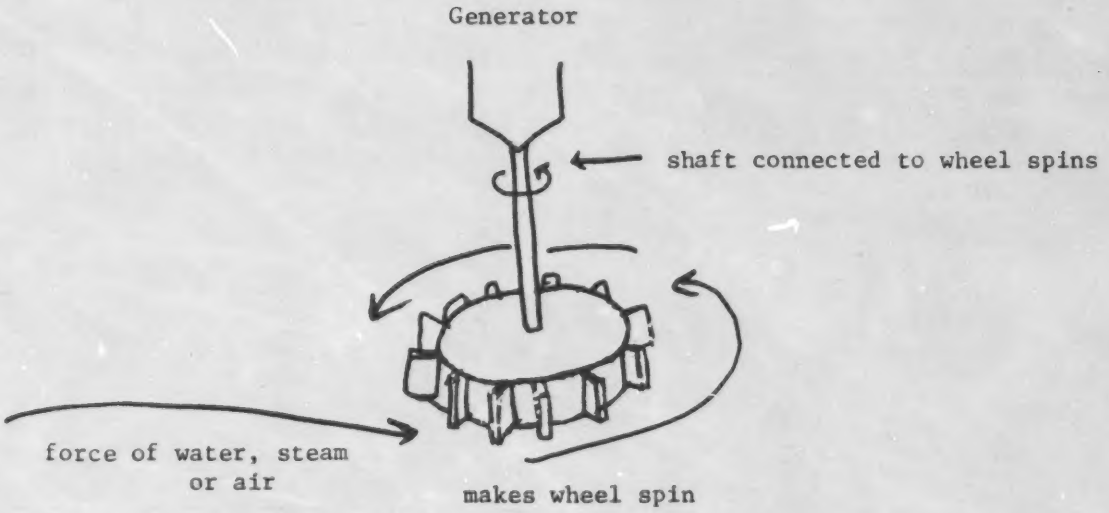
Match the mechanical part with the correct category.

| | |
|---|---|
| _____1. Battery | A. Prime Mover |
| _____2. Drive Shaft | B. Drive or Gearing System |
| _____3. Cylinder | C. Propulsion System |
| _____4. Propeller blades | D. Auxiliary |
| _____5. Alternator | |
| _____6. Transmission | |
| _____7. Differential | |
| _____8. Car wheels | |
| _____9. Piston | |

## ANSWERS TO THE SAMPLE TEST ITEMS

| OBJECTIVE | SAMPLE TEST ITEM | ANSWER |
|---|---|---|
| 1.0 | 1 | False |
| | 2 | True |
| 2.0 | 1 | Piston |
| | 2 | Cylinder |
| | 3 | Crankshaft |
| | 4 | Flywheel |
| | 5 | Transmission |
| | 6 | Driveshaft |
| | 7 | Differential |
| | 8 | Battery |
| | 9 | Fan belt |
| | 10 | Alternator |
| 3.0 | 1 | E |
| | 2 | I |
| | 3 | F |
| | 4 | B |
| | 5 | A |
| | 6 | C |
| | 7 | D |
| | 8 | H |
| | 9 | J |
| | 10 | G |
| 4.0 | 1 | The little gear turns twice as the big gear turns once |
| | 2 | gears |

| OBJECTIVE | SAMPLE TEST ITEM | ANSWER |
|---|---|---|
| 5.0 | 1 | Steam,water or air pushes against blades on a wheel. The wheel then turns sending energy up through a shaft to a generator |




6.0

| ITEM | ANSWER |
|---|---|
| 1 | D |
| 2 | B |
| 3 | A |
| 4 | C |
| 5 | D |
| 6 | B |
| 7 | B |
| 8 | C |
| 9 | A |

PROBLEM SOLVING

Five-Step Problem-Solving Method

OBJECTIVE 1.0 Given a set of verbal reasoning problems to solve, the learner will apply the 5-step problem solving method. This objective will be achieved when the learner solves 90% of the problems, and illustrates how he/she applied the 5-step problem solving method.

SAMPLE TEST ITEM:

1. Belvedere street is parallel to St. Anthony Street. Davidson Street is perpendicular to River Street. River Street is parallel to St. Anthony Street. Is Davidson Street parallel or perpendicular to Belvedere Street?

2. It is your job to plan the Watch Bill for standing watch in the work shop from Monday through Friday. Using the schedule of availability below, assign each man a day (8 AM to 5 PM) to stand watch. (Note: you cannot assign any of the men more than one watch day.)

   Man 1 is returning from leave at noon on Thursday.
   Man 2 is assigned to special training from Tuesday through Friday.
   Man 3 has a legal appointment Monday, Wednesday and Friday afternoons.
   Man 4 is receiving medical treatment on Monday, Tuesday and Wednesday mornings.
   Man 5 is available all week.

## Tree Diagram Problem Solving

OBJECTIVE 2.0 Given problems requiring progressive analysis, the learner will apply the decision tree problem solving strategy. The objective will be achieved when the learner illustrates how he/she applied the decision tree strategy for a minimum of three levels.

SAMPLE TEST ITEM:

1. Use the tree diagram strategy on the problem below.

   John must decide whether to accept a job offer as a sales clerk. Should he accept the job?

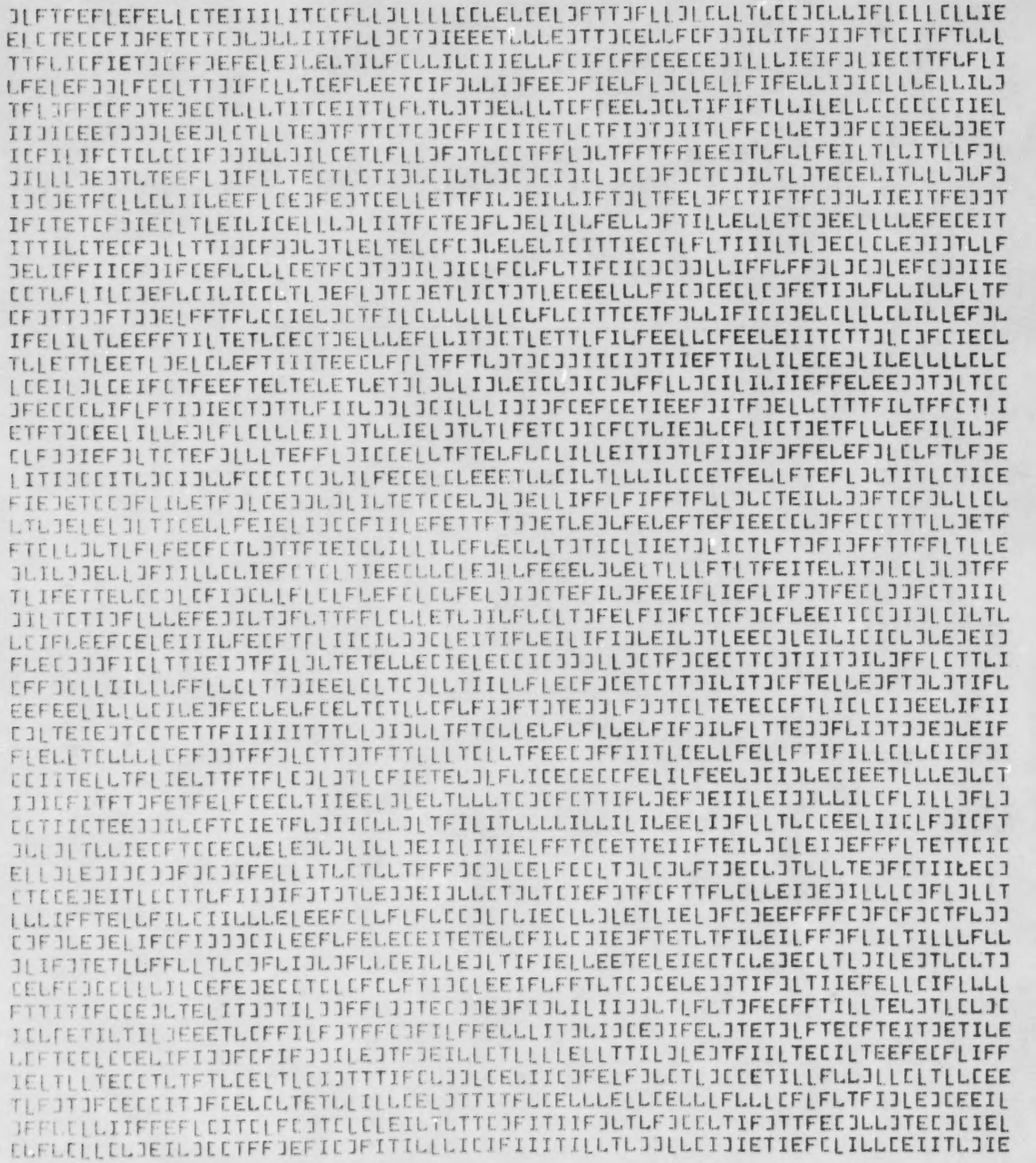
2. A civilian friend of yours is doing some work on a Navy base. He's been having a problem distinguishing the rate/rank insignia worn by Navy Personnel. Use the tree diagram method to help him determine: who is a seaman; who is a petty officer, and who is an officer. (Use the sleve insignia only).

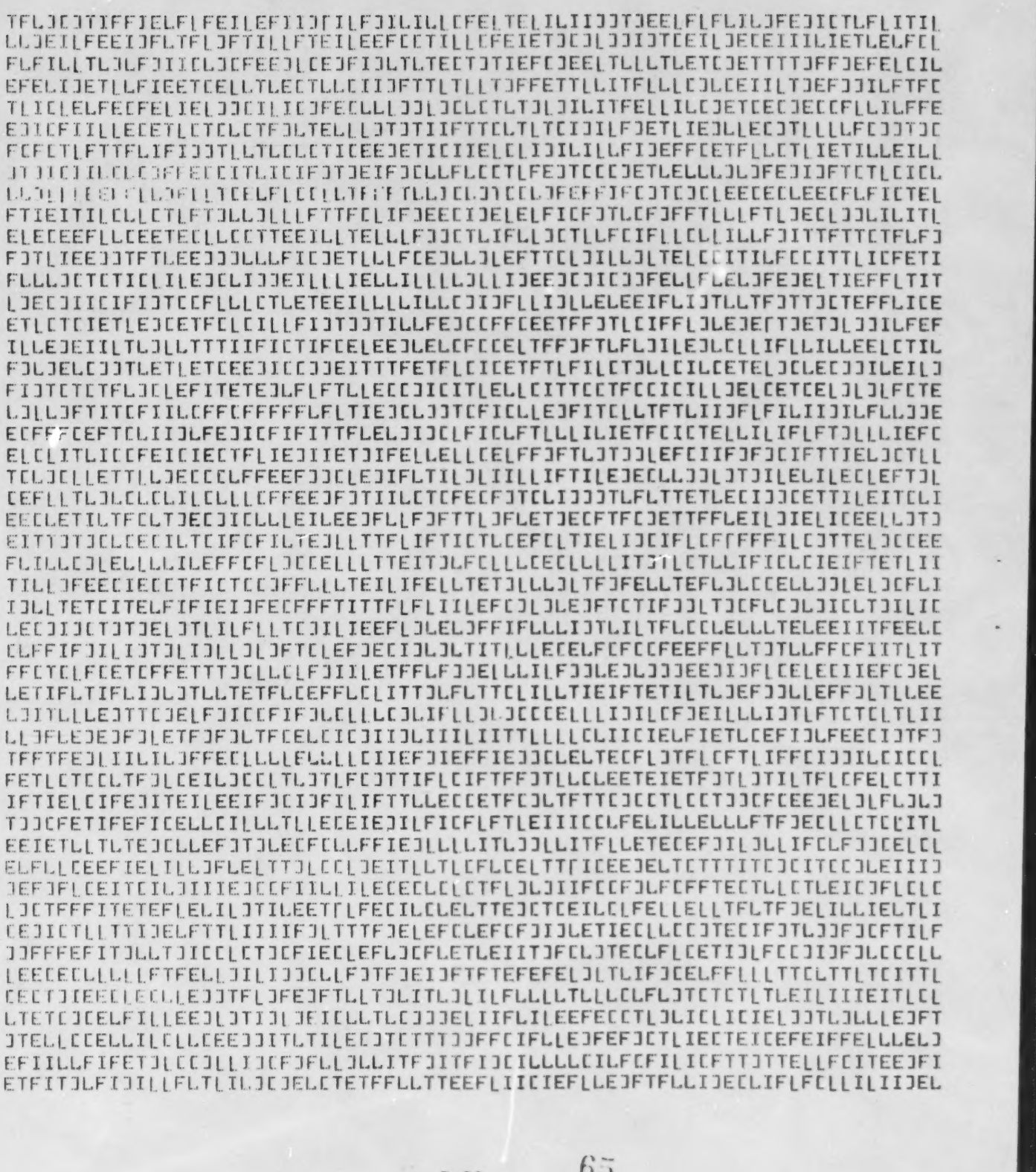
## Vigilance

OBJECTIVE 3.0 Given a forty minute vigilance task, the learner will participate in the task and then graph his/her vigilance performance.

SAMPLE TEST ITEM:

Scan the symbols on the next two pages very carefully. Everytime you encounter the symbol '⌐' circle it.





ANSWERS TO THE SAMPLE TEST ITEMS

OBJECTIVE 1.0 5-Step Method

ITEM 1:

Step 1 - This problem can be solved!

Step 2 - The specific problem is: "Is Davidson Street, parallel or perpendicular to Belvedere Street"? To solve the problem you must know the relationship of the streets to each other.

Step 3 - Don't jump to conclusiors - start at the beginning and work through the problem.

Step 4 - Begin breaking the problem into manageable parts;

A. Belvedere St. is parallel to St. Anthony St.

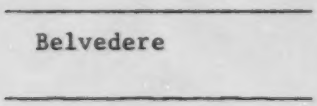
B. Davidson St. is perpendicular to River St.

C. River St. is parallel to St. Anthony St.

Recheck to make sure the breakdown is correct.

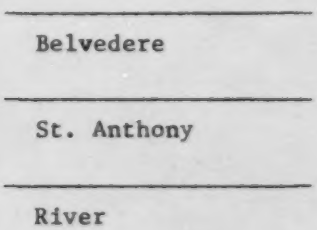
Step 5 - Diagram the breakdown

A. Belvedere is parallel to St. Anthony

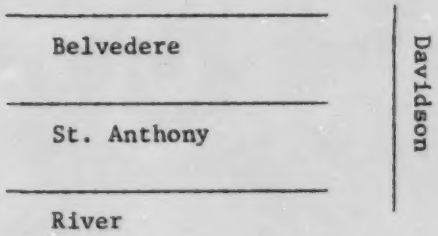



B. The relationship between Davidson and River to Belvedere and St. Anthony is unknown at this time so skip Step B temporarily.

C. River is parallel to St. Anthony



D. Now, return to Step B. Can it be worked out now?




E. Recheck the problem. Is it solved correctly?

F. Yes. The answer to the question posed in Step 2 is:
Davidson St. is perpendicular to Belvedere.

ITEM 2:

Step 1 - This problem can be solved!

Step 2 - The specific problem is: To plan the watchbill so that each man serves watch only one day.

Step 3 - Don't jump to conclusions - work out a schedule step by step to pick the best day for each man.

Step 4
and
Step 5 - The schedule is already listed, but it can be organized by writing the available days on a calendar.

A.

| M | T | W | Th | F |
|---|---|---|---|---|
| MAN 2 | MAN 3 | | MAN 3<br>MAN 4 | MAN 1<br>MAN 4 |
| MAN 5 | MAN 5 | MAN 5 | MAN 5 | MAN 5 |

1) Man 1 is only available on Friday

| M | T | W | Th | F |
|---|---|---|---|---|
| | | | | MAN 1 |

2) Man 2 is only available on Monday

| M | T | W | Th | F |
|---|---|---|---|---|
| MAN 2 | | | | Man 1 |

3) Man 3 is available on Tuesday and Thursday, so skip him temporarily and check on availability of Man 4 and 5.

4) Man 4 is **available** Thursday and **Friday**, but Man 1 is already assigned to Friday, so Man 4 is assigned to Thursday.

| M | T | W | Th | F |
|---|---|---|---|---|
| MAN 2 | | | MAN 4 | MAN 1 |

5) Go back to Man 3. Since Thursday has been assigned to Man 4, Man 3 is assigned Tuesday.

| M | T | W | Th | F |
|---|---|---|---|---|
| MAN 2 | MAN 3 | | MAN 4 | MAN 1 |

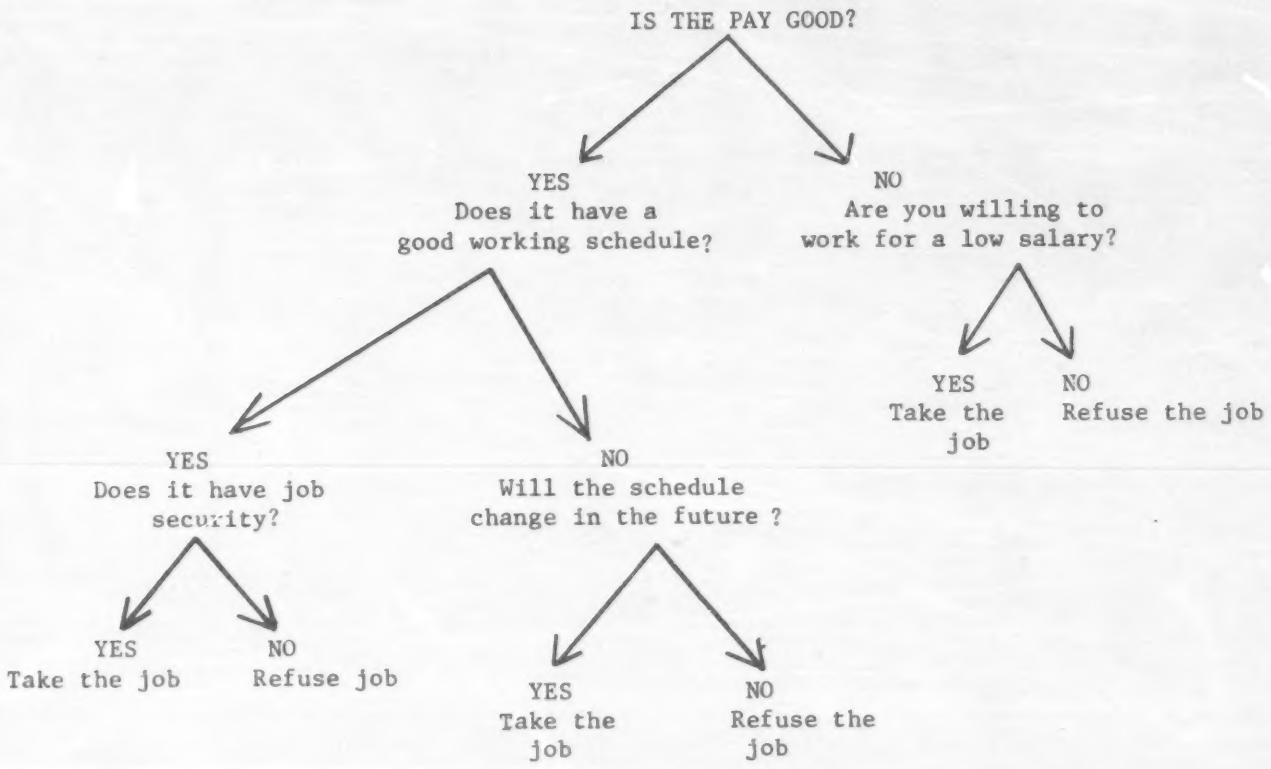
6) Man 5 is available all week, but none of the other men are available on Wednesday

B. The answer to the problem is:

| M | T | W | Th | F |
|---|---|---|---|---|
| MAN 2 | MAN 3 | MAN 5 | MAN 4 | MAN 1 |

OBJECTIVE 2.0 TREE DIAGRAM METHOD

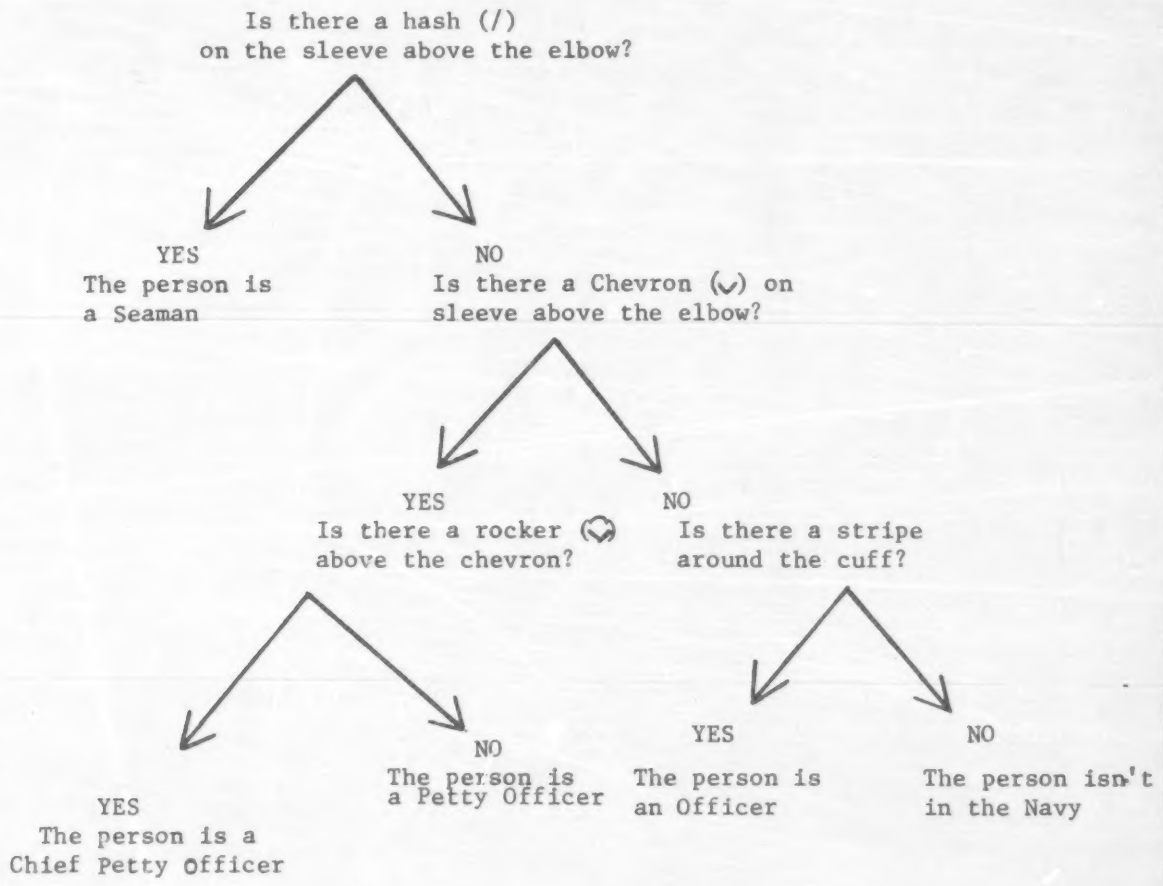
Item 1: Should he accept the job?

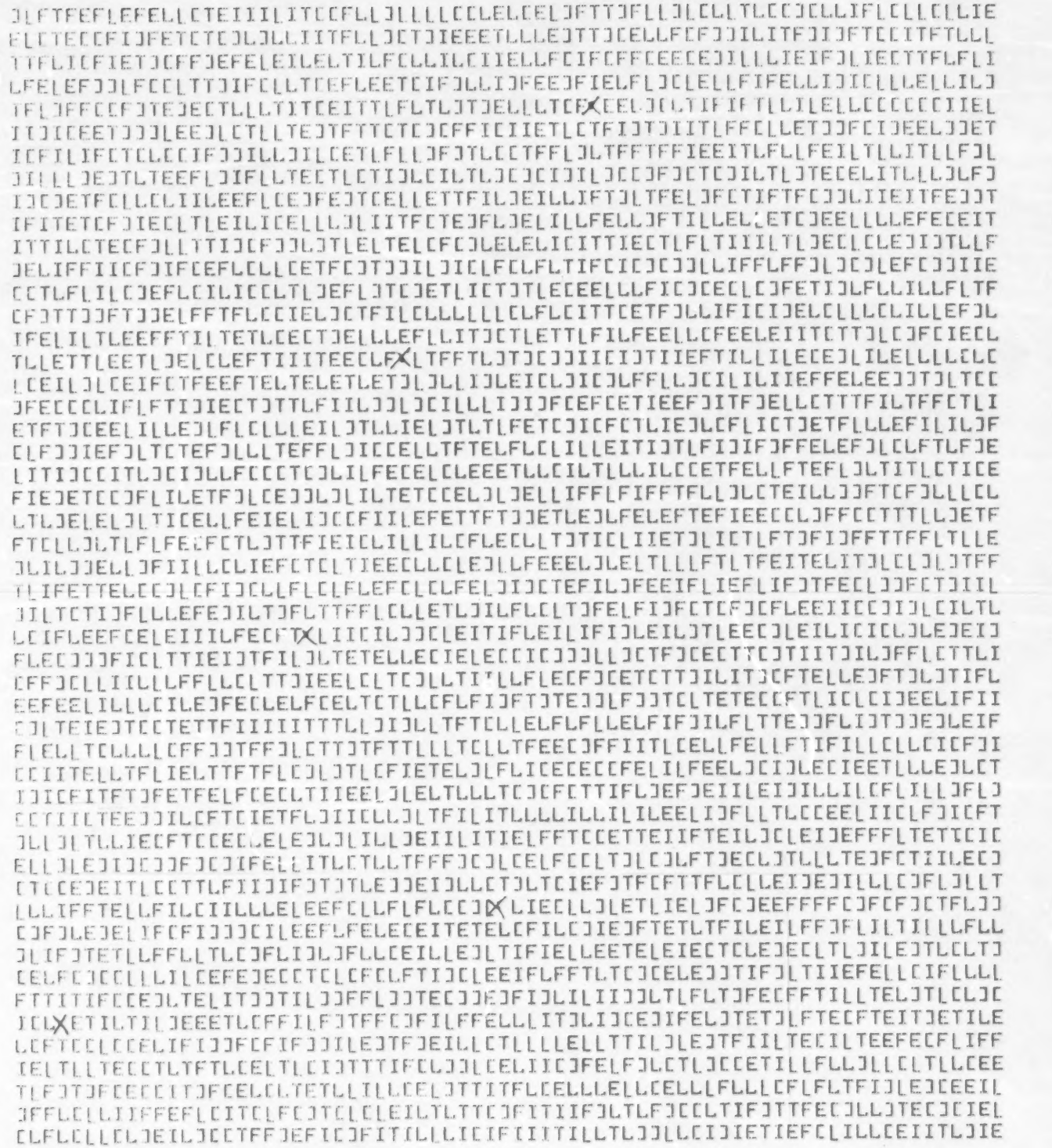


ITEM 2:

2. A civilian friend of yours is doing some work on a Navy base. He's been having a problem distinguishing the rate/rank insignia worn by Navy personnel. Use the tree diagram method to help him determine: who is a seaman; who is a petty officer; and who is an officer. (Use only the sleeve insignia).

ANSWER: Item 2


Is there a hash (/) on the sleeve above the elbow?
YES
The person is a Seaman
NO
Is there a Chevron (⌄) on sleeve above the elbow?
YES
Is there a rocker (⌒) above the chevron?
NO
Is there a stripe around the cuff?
YES
The person is a Chief Petty Officer
NO
The person is a Petty Officer
YES
The person is an Officer
NO
The person isn't in the Navy



## APPENDIX E

## INSTRUCTIONAL SPECIFICATIONS

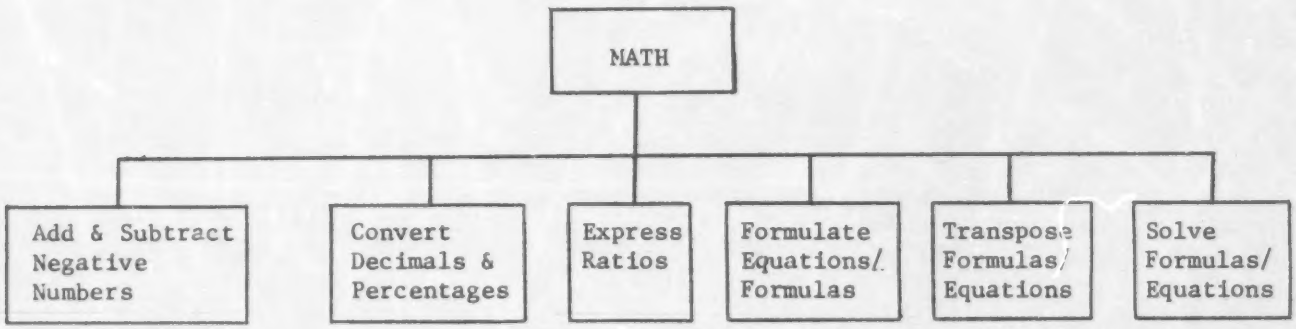

| Area | Page |
|---|---|
| Mathematics | E-1 |
| Study Skills | E-9 |
| Science | E-15 |
| Mechanical Operations and Relationships | E-24 |
| Problem Solving | E-31 |

## MATHEMATICS

### Introduction

The Basic Skills Analysis revealed several math prerequisite requirements, including: adding and subtracting negative numbers, converting decimals and percents, expressing ratios, and solving formulas (or equations). Sensor operators need to know how to formulate equations/formulas from the data received, and how to manipulate formula/equation variables to arrive at a solution. This requires a knowledge of how to use and manipulate negative numbers, ratios, percents, and decimals.

### Major Topic Areas



## Adding and Subtracting Negative Numbers

### Objective

1.0 Given a set of mathematical problems, be able to add and subtract negative numbers (without a calculator). The standard is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

N/A

### Instance Specifications

| Types of Operation | Example | Practice | Test |
|---|---|---|---|
| **Adding Negative Numbers** | | | |
| 1. Column format | | | |
| a) two addends | 1 | 3 | 3 |
| b) three addends | 1 | 3 | 3 |
| 2. Row format | | | |
| a) two addends | 1 | 3 | 3 |
| b) three addends | 1 | 3 | 3 |
| **Subtracting Negative Numbers** | | | |
| 1. Column format | | | |
| a) 1 minuend and 1 subtrahend | 1 | 3 | 3 |
| b) 1 minuend and 2 subtrahends | 1 | 3 | 3 |
| 2. Row format | | | |
| a) 1 minuend and 1 subtrahend | 1 | 3 | 3 |
| b) 1 minuend and 2 subtrahends | 1 | 3 | 3 |

### Testing

The objective will be tested by giving the students a set of negative number problems to solve.

Converting Decimals & Percentages

Objective

2.0 Given a list of numbers expressed as decimals or percentages, convert the decimal numbers into percentages and the percentages into decimal numbers with 90% accuracy.

Objective Type

Rule use unaided.

Instructional Media/Method

Lecture and Print.

Strategy Specifications

N/A

Instance Specifications

| Converting Decimals to Percents | | | |
|---|---|---|---|
| Type of Decimal Numbers | Example | Practice | Test |
| 1. One digit decimal number | 1 | 2 | 2 |
| 2. Two digit decimal number | | | |
| a) with leading zeros | 1 | 2 | 2 |
| b) without leading zeros | 1 | 2 | 2 |
| 3. Three digit decimal number | | | |
| a) numbers on right and left side of the decimal point | 1 | 2 | 3 |
| b) numbers all on the right side of the decimal point | 1 | 2 | 3 |

| Converting Percents to Decimals | | | |
|---|---|---|---|
| Types of Percents | | | |
| 1. One digit percent | 1 | 2 | 2 |
| 2. Two digit percent | | | |
| a) with a decimal point | 1 | 2 | 2 |
| b) without a decimal point | 1 | 2 | 2 |
| 3. Three digit percent | | | |
| a) with a decimal point | 1 | 2 | 2 |
| b) without a decimal point | 1 | 2 | 2 |

Testing

The objective will be tested by presenting the students with a series of percents to be converted to decimal numbers and decimals to convert to percents.

## Expressing Ratios

### Objective

3.0 Given two items to be compared, express the relationship between the items as a ratio and provide the solution as a decimal value to the nearest 10th. The standard is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specification

Sensor operators work with gear reduction ratios and the drive shaft to propeller ratios constantly. Whenever possible ratio examples and practice exercises should be job related.

### Instance Specification

| Types of Ratio Problems | Example | Practice | Test |
|---|---|---|---|
| 1. Word problems | 2 | 2 | 2 |
| 2. Problems with diagram or figure aids | 4 | 4 | 3 |

### Testing

The objective will be tested when the values in the problem are expressed as a ratio.

## Formulating Word Problems

### Objective

4.0 Given word problems with one unknown value, be able to formulate an equation expressing the relationship stated in the word problem and then solve the equation for the unknown value. The standard is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

Kalmykova (1975) presents the following steps for solving mathematical word problems:

1. Emphasize proper reading of the problem.

   Each problem needs to be read aloud with the proper intonation emphasizing each word and using the punctuation to help understand the problem. Practice exercises should involve each student reading word problems aloud and having the class critique the reading.

2. Breakdown the text.

   After reading the problem, each of the datum, especially the unknown, should be enumerated. Identify unfamiliar words and define them. To get a more detailed picture, questions should be asked, such as: what kind of widgets or how many.

3. Emphasize the differentiation of concepts.

   The operational vocabulary of the word problem needs to be translated into mathematical terminology. For example; "I have $5.00. How much money will I have if I receive 10 more dollars?" would be changed to "How much money will I have if I ADD 5 dollars to 10 dollars?" Practice exercises should include drills translating vocabulary to match operations so that students will learn to differentiate similar concepts, such as more than, greater than, and so many times bigger than.

4. Emphasize substantiation of the method of solving the problem from the text.

   Choices of operation are controlled when they are verified in the text. For example, if a student wants to subtract 6 logs from 10 logs, the student must show which section of the problem indicates that the operation is necessary.

5. Emphasize the question of the word problem.

Students need to understand that the goal of the problem is to answer the question and solve the unknown. Practice exercises should include different questions requiring the same mathematical operations. For example: John bought 20 notebooks and gave half to his sister. 1) how many notebooks did John have left? 2) What is one-half of the notebooks equal to? 3) how many notebooks did John give his sister?

6. Emphasize analysis of solution errors.

Part of the learning process involves students analyzing their errors. Using the practice exercises students should help each other analyze problem solving errors.

Instance Specifications

| Type of Word Problem | Example | Practice | Test |
|---|---|---|---|
| 1. Solving for 1 unknown | 3 | 8 | 6 |

Testing

The objective will be tested by having the students formulate an equation and provide a solution to a set of word problems.

## Transposing Formulas

### Objective

5.0 Given various algebraic formulas, be able to transpose the formulas to solve for a requested value. The standard is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

Most of the formulas that sensor operators use involve two known values and one unknown. Bogolyubov (1972) suggests that many questions should be asked about each problem. This would require the student to manipulate the problem variables and solve for various unknowns. For example, "If 2 lbs of cherries cost $5.00, how much would 15 lbs cost?" This problem is based on the common premise of price, quantity, and cost. In this case, cost and quantity are known and price is the unknown. Students should then be asked to solve, "If 2 lbs of cherries cost $5.00 and John paid a total of $37.50, how many pounds of cherries did John buy?" The second question requires the students to transpose the problem's solution and solve for quantity, with price and cost as givens. The third question would naturally require the student to solve for cost with quantity and price unknown.

Since acoustic sensor operators primarily use three variable formulas, there should be a heavy instructional emphasis on transposing three variable problems. For example, another common premise that would be particularly appropriate for acoustic sensor ratings is distance, time and speed.

The previous discussion has primarily emphasized the concept of equation transformation. This segment of instruction should also cover the mechanical operations that are necessary to transpose variables to either side of the equal sign to solve the equation.

### Instance Specifications

| Type of Operation Required to Transpose Formulas | Example | Practice | Test |
|---|---|---|---|
| 1. Addition | 2 | 3 | 4 |
| 2. Subtraction | 2 | 3 | 4 |
| 3. Multiplication | 2 | 3 | 4 |
| 4. Division | 2 | 3 | 4 |

### Testing

The objective will be tested by providing students with a series of algebraic formulas to transpose to solve for a requested value.

## Solving Word Problems

### Objective

6.0 Given a word problem that requires the manipulation of two formulas, be able to solve both formulas to obtain the problem's solution. The criterion is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

See strategy specifications for Objective 4.0.

### Instance Specifications

| Type of word problem | Example | Practice | Test |
|---|---|---|---|
| 1. Word problems requiring two formulas to solve | 2 | 6 | 4 |

### Testing

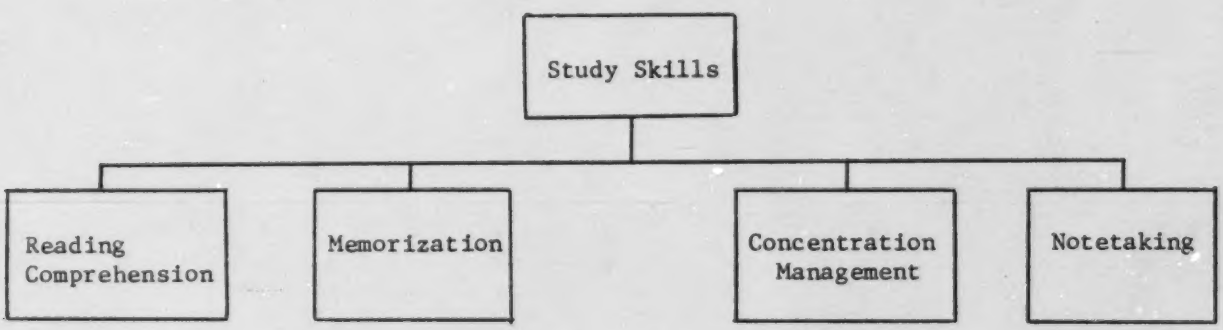
The objective will be tested by giving students word problems requiring the manipulation of two formulas to provide the solution.

## STUDY SKILLS

### Introduction

The application of good study skills is fundamental to success in many learning situations. The results of questionnaires and personal interviews conducted among the AW, STG, STS and OT Acoustic Sensor Operation Communities indicated that study skills is an area that needed improvement. Emphasis will be placed on the following four areas: reading comprehension, memorization, concentration management and notetaking. Instruction in these four areas should improve "A" school performance and ultimately their assignment in the fleet.

### Major Topic Areas



## Notetaking

### Objective

1.0 Given a written passage, the learner will demonstrate notetaking techniques by listing main and supporting ideas in an abbreviated format or by using the networking strategy.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

The steps involved in using the notetaking technique of listing the main and supporting ideas in an abbreviated format are:

1. Determine the main idea.
2. Determine the supporting ideas.
3. Write the main and supporting ideas in an abbreviated format.

The steps involved in using the networking strategy are:

1. Read the material and write down the important words and ideas.
2. Note the relationships between the important ideas.
3. Network/organize the important information in your own style. For example the networks should highlight the important ideas and the relationship between them. This might include adding personal comments, diagrams, pictures or questions, anything that clarifies the material (Drobrovolny, McCombs, and Judd, 1980.)

### Instance Specifications

| Type of Notetaking | Examples | Practice | Test |
|---|---|---|---|
| 1. Listing main and supporting ideas in an abbreviated format | 3 | 4 | 2 |
| 2. Networking | 3 | 4 | 2 |

### Testing

The objective will be tested by demonstrating the notetaking techniques of networking and listing main and supporting ideas in an abbreviated format.

Memorization

Objective

2.0 The learner will be able to list the steps associated with each of the following mnemonic techniques: pegword, association chain, story and pattern.

Objective Type

Remember rule.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

1. The steps involved in creating the pegword mnemonic are:

   a. Learn a set of pegwords. The following list is an example of traditional pegwords, but other words could be substituted. The only requirement for pegwords is that they rhyme with the number they are associated with.

| | |
|---|---|
| one is a bun | six is a stick |
| two is a shoe | seven is heaven |
| three is a tree | eight is a gate |
| four is a door | nine is a line |
| five is a hive | ten is a hen |

   b. Visualize each item to be memorized with a pegword. The following is an example of a pegword mnemonic: To remember that mega = 1,000,000 or $10^6$, visualize a mega phone yelling at sticks. The "mega" is the prefix, and sticks is a pegword generally associated with 6, the number of zeros.

2. The steps involved in creating an association chain mnemonic are:

   a. List the mental associations that come to mind when you think about the material to be remembered.

   b. Determine the mental association in step 1 that led you, by a chain of associations, to the material to be remembered.

   c. Be sure that the association you formulated makes it possible to differentiate between other, similar material.

   d. Diagram the association you developed to make the chain of association clear. For example to memorize the word "density": density - dense is he - thick skulled - more skull per unit volume than most people.

3. To create a story mnemonic do the following:

   a. Construct a simple one or two sentence story that contains the information to be remembered. For example, to remember that the colors of the flags signifying the numbers 4 and 7 are a combination of red and white, the story mnemonic might be: Mrs. Flag who is 47, wore her red and white blouse to the Valentine's Day dance.

4. The steps involved in creating a pattern mnenomic are:

   a. Learn the "key" to the pattern. This involves recognizing the repetitious aspect of what is to be memorized, and in some cases organizing it. For example the number 893938 involves repetition. Recognizing that the number begins and ends with an 8, and contains two 93's in the middle, makes it easier to remember. Instead of memorizing 6 individual numbers in order, you are learning 2 repetitious chunks of information - the 93's and the 8's. Another example of a pattern mnemonic requiring organization would be to memorize a variety of tools and their individual characteristics or uses. If a chart, either a mental or written one, was constructed to organize the tools into categories, such as those that drill and those that saw, you would have a pattern mnemonic. The material would be organized into related subsets that make it easier to remember.

   b. State the rule of the pattern to solidify it in your mind.

5. A pretest and posttest consisting of job related terms should be developed. Students will be given the pretest before classroom instruction on mnemonics begins and the posttest after instruction is completed. (For more information on mnemonics see Braby and Kincaid, 1978.)

Instance Specifications

| Type of Mnemonic | Examples | Practice | Test |
|---|---|---|---|
| Pegword | 2 | 4 | 2 |
| Association Chain | 2 | 4 | 2 |
| Story | 2 | 4 | 2 |
| Pattern | 2 | 4 | 2 |

Testing

The objective will be tested by listing the steps associated with each of the following mnemonic techniques: pegword, association chain, story and pattern.

Reading Comprehension

Objective

3.0 The learner will be able to list the steps involved in the questioning and problem solving methods.

Objective Type

Remember rule.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

The steps involved in using the questioning method on a paragraph are:

1. Read the paragraph and determine the main idea.
2. Make up a question that asks for an example of the main idea of the paragraph.
3. Learn the answer to the question you made up.

The steps involved in using the problem solving method are:

1. Determine the nature of the problem.
2. Gather additional information to simplify the problem.
3. Check the conclusion you came to, and correct it if necessary.

Instance Specifications

Questioning Method

| Types of Data | Examples | | | Practice | | | Test | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Where main idea is found | | | | | | | | | |
| 1. first sentence | X | | | | | X | X | | |
| 2. middle of paragraph | | X | | X | | | | X | |
| 3. last sentence | | | X | | X | | | | X |
| Question | | | | | | | | | |
| 1. write question based on main idea, in own words | X | X | X | | X | | X | X | X |
| Learn Answer | | | | | | | | | |
| 1. remember answer | X | | | X | | X | X | | X |
| 2. look answer up in text | | X | X | | X | | | X | |

Concentration Management

Objective

4.0 Given a scenario of a stressful situation, the learner will recommend and illustrate the use of either the self-talk or relaxation technique for creating a more positive mood.

Objective Type

Rule use unaided.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

The steps involved in using the self-talk method to create a more positive mood are:

1. Determine what is bothering you, what is interfering with your positive study mood.
2. Talk yourself into a good study mood by addressing the problem you determined in step 1 and finding some way to solve it.

The steps involved in using the relaxation technique for creating a more positive mood are:

1. Get in a comfortable position and close your eyes.
2. Clear your mind of stressful thoughts.
3. Relax all the muscles in your body.
4. Take a deep breath and hold it. Exhale slowly. Repeat.

(For more information on concentration management see Drobrovolny, McCombs, and Judd, 1980).

Instance Specification

| Techniques for Mood Creation | Example | Practice | Test |
|---|---|---|---|
| Self-talk | 3 | 4 | 2 |
| Relaxation | 2 | 3 | 2 |

Testing

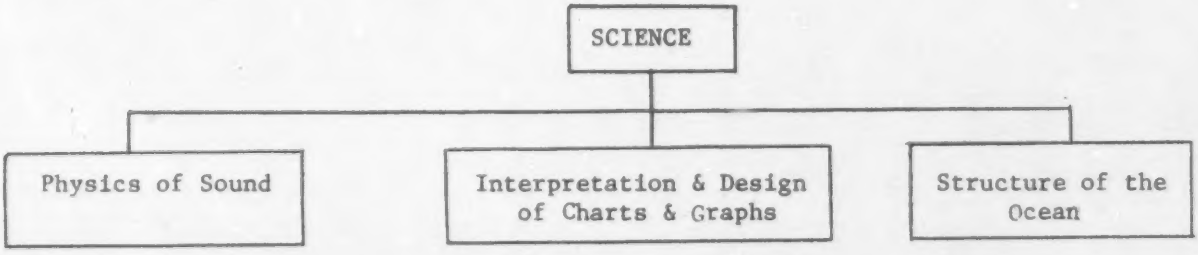
The objective will be tested by demonstrating the use of either the self-talk or relaxation techniques for creating a more positive mood when presented with a scenario of a stressful situation.

## SCIENCE

### Introduction

Surveys and interviews with subject matter experts from OT, AW, STS, and STG "A" school and common core revealed a science prerequisite for the Acoustic Sensor Operations ratings. The science requirement consists of three main areas: physics of sound, charts and graphs, and structure of the ocean. The physics of sound is the most important of the three areas and covers the production, transmission and propagation of sound, frequency and sound wavelengths, and sound mediums. The second area involves both the interpretation and design of charts and/or graphs. The ocean structure area includes general ocean knowledge and geography of the ocean basin.

### Major Topic Areas



Production of Sound

Objective

1.0 Given a short answer test, be able to list and define the three basic elements that are necessary before sound can be produced. The criterion is 100%.

Objective Type

Remember category.

Instructional Media/Method

Lecture and Print.

Strategy Specifications

The three elements should be illustrated with diagrams to present a clear picture of sound mediums. Students should also be presented with an example in which one of the three elements is missing resulting in no sound production (e.g. a bell ringing in a vacuum).

Instance Specifications

| Types of Elements | Example | Practice* | Test |
|---|---|---|---|
| 1. Source of Sound | 2 | 1 | 2 |
| 2. Sound Medium | 2 | 1 | 2 |
| 3. Detector | 2 | 1 | 2 |

*Students should make up an example of each of the elements.

Testing

The objective will be tested by having the students list the three basic elements with a brief definition.

Sound Generation

Objective

2.0 Using the tuning fork as an example, the student will write a short answer explanation of sound generation. The answer must contain motion/vibration, sound waves and medium.

Objective Type

Remember principle.

Instructional Media/Method

Lecture, demonstration and print.

Strategy Specifications

The element to emphasize in this instruction is the motion/vibration action necessary to generate sound. This concept should be illustrated with examples of motion, such as: levers moving up and down, the firing of a gas combustion engine, or turning propeller blades.

Instance Specifications

| Types of Sound Generation | Example | Practice* | Test |
|---|---|---|---|
| 1. Machinery | 2 | 2 | 0 |
| 2. Tuning Fork | 1 | 1 | 1 |

*Students should make up examples of motion/vibration sound generation

Testing

The objective will be tested by describing how a tuning fork generates sound.

Sound Wavelengths

Objective

3.0 Given a diagram of a wave pattern, be able to label parts of the diagram to illustrate cycle, wavelength, amplitude, and frequency. The criterion is 90% of the items labeled correctly.

Objective Type

Category use unaided.

Instructional Media/Method

Lecture, print and diagram.

Strategy Specifications

The purpose of this objective is to expand the student's general knowledge of sound wavelengths. The concept and calculation of frequency is the most important element in this segment.

Instance Specifications

| Types of Wave Patterns | Example | Practice | Test |
|---|---|---|---|
| 1. High frequency wavelength | 1 | 1 | 2 |
| 2. Low frequency wavelength | 1 | 1 | 2 |

Testing

The objective will be tested by labeling the cycle, wavelength amplitude and frequency of a sound wavelength.

Sound Propagation & Media

Objective

4.0 Given a short answer test, be able to answer questions on the relationship between sound mediums and sound propagation. The standard is 90%.

Objective Type

Principle use unaided.

Instructional Media/Method

Lecture and Print.

Strategy Specifications

The instruction must communicate the effect that sound mediums have on sound propagation. Emphasis should be placed on sound transmission in sea water and especially the effects of temperature, pressure and salinity on sea water as a medium.

Instance Specifications

| Types of Sound Medium | Example | Practice | Test |
|---|---|---|---|
| 1. Fresh water | 1 | 1 | 1 |
| 2. Sea water | | | |
| a. temperature | 1 | 2 | 2 |
| b. pressure | 1 | 2 | 2 |
| c. salinity | 1 | 2 | 2 |
| 3. Air | 1 | 1 | 1 |
| 4. Solid medium | 1 | 1 | 1 |

Testing

The objective will be tested by correctly answering test questions on the relationship between sound mediums and sound propagation.

Sound Propagation Terms

Objective

5.0 Given a list of sound propagation terms and definitions, be able to match the term with the correct definition. The criterion is 90%.

Objective Type

Remember fact.

Instructional Media/Method

Lecture and Print.

Strategy Specifications

N/A

Instance Specifications

| Type of Terms | Example = Definition | Practice | Test |
|---|---|---|---|
| Sound Propagation | ✓ | ✓ | ✓ |

Testing

The objective will be tested by matching the definitions to the correct term.

## Charts and Graphs

### Objective

6.0 Given a graph or chart, be able to interpret the data displayed. The standard is 90%.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and print, (including charts and/or graphs).

### Strategy Specifications

The examples, practice and test items should be Navy related.

### Instance Specifications

| Types of Data | Examples | Practice | Test |
|---|---|---|---|
| Graph | 3 | 4 | 2 |
| Chart | 3 | 4 | 2 |

### Testing

The objective will be tested by correctly interpreting data displayed on a graph or chart.

## Graph Design

### Objective

7.0 Given a blank graph showing an X and Y axis and a set of data, be able to label each axis and plot the data on the graph. The standard is 100% of the data plotted correctly.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

N/A

### Instance Specifications

| Types of data | Example | Practice | Test |
|---|---|---|---|
| Label axis | | | |
| X | 1 | 1 | 2 |
| Y | 1 | 1 | 2 |
| Plot data | | | |
| X | 3 | 4 | 2 |
| Y | 3 | 4 | 2 |

### Testing

The objective will be tested by both correctly labeling the axis, and plotting data on a blank graph.

## Structure of the Ocean

### Objective

8.0 Given a short answer and multiple choice test, be able to demonstrate knowledge of the structure of the ocean. The criterion is 90%.

### Objective Type

Remember category.

### Instructional Media/Method

Print/lecture and relief map demonstration.

### Strategy Specifications

This section should emphasize the structure of the ocean in a general way. The intent here is not to teach specific names and locations, but rather to provide an overall awareness of the physical, and especially the geological aspects of the ocean. To ensure the students understanding of the geological structures of the ocean, a relief map should be used to demonstrate them.

### Instance Specifications

| Types of Ocean Structures | Examples | Practice | Test |
|---|---|---|---|
| Geological Oceanography | | | |
| 1. continental shelf | 2 | 3 | 1 |
| 2. ocean trenches | 2 | 3 | 1 |
| 3. sea mounts | 2 | 3 | 1 |
| 4. submarine canyons | 2 | 3 | 1 |
| 5. ocean ridges | 2 | 3 | 1 |
| 6. ocean basins | 2 | 3 | 1 |
| 7. ocean fractures | 2 | 3 | 1 |
| Physical Oceanography | | | |
| 1. currents | 1 | 2 | 1 |
| 2. temperature | 1 | 2 | 1 |
| 3. salinity | 1 | 2 | 1 |
| 4. pressure | 1 | 2 | 1 |

### Testing

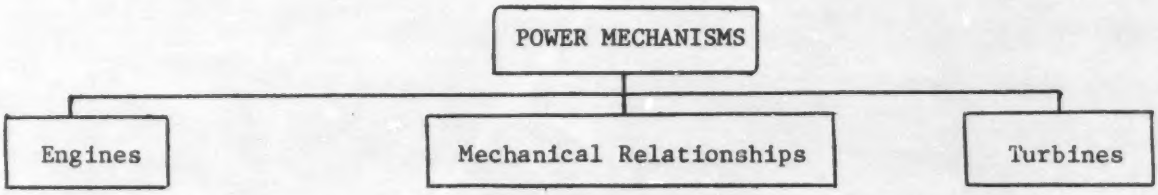
The objective will be tested by the use of a short answer and multiple choice test concerning geological and physical aspects of the ocean.

## MECHANICAL OPERATIONS AND RELATIONSHIPS

### Introduction

In the "A" schools, students are taught in detail how particular power mechanisms work. The details of a ship's engine functions, such as the four stroke cycle, would be easier to learn if the students had an idea of what an engine, in general, looks like and how the parts of the engine interact. Unfortunately, this rudimentary knowledge cannot be presumed by the "A" school. Three areas of concern include engine shapes and types, mechanical relationships among engine parts, and turbine operation. The first two areas use the automobile engine as a model.

### Major Topic Areas



Engines - Diesel/Gas

Objective

1.0 Given a series of true/false statements concerning gas and diesel engines, the learner will determine whether each statement is true or false. The criterion is 90%.

Objective Type

Remember category.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

The emphasis here should be on the differences between the gas engine and the diesel engine. It is not important for the student to memorize the names of specific parts. The engine stroke cycle should also be briefly introduced (e.g. the major difference between a 2 stroke and 4 stroke cycle.)

Instance Specifications

| Types of Engines | Example | Practice Remembering | Test |
|---|---|---|---|
| Gas | 3 | 1 | 2 |
| Turbine | 3 | 1 | 2 |

Testing

This objective will be tested by correctly answering a series of true/false statements concerning gas and diesel engines.

## Identifying Mechanical Parts

### Objective

2.0 Given a diagram of a car's engine, drive shaft, and electrical auxiliaries, the learner will label the following parts: piston, alternator, cylinder, crankshaft, flywheel, transmission, fan belt, drive shaft, differential and battery. The standard is 90%.

### Objective Type

Remember fact.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

Use diagrams to clearly illustrate the engine parts.

### Instance Specifications

| Types of Engine Parts | Example of Engine Part | Practice Remembering | Test |
|---|---|---|---|
| Piston | 1 | 1 | 1 |
| Alternator | 1 | 1 | 1 |
| Cylinder | 1 | 1 | 1 |
| Crankshaft | 1 | 1 | 1 |
| Flywheel | 1 | 1 | 1 |
| Transmission | 1 | 1 | 1 |
| Fanbelt | 1 | 1 | 1 |
| Drive shaft | 1 | 1 | 1 |
| Differential | 1 | 1 | 1 |
| Battery | 1 | 1 | 1 |

### Testing

This objective will be tested by correctly identifying the following parts on a diagram: piston, alternator, cylinder, crankshaft, flywheel, transmission, fan belt, drive shaft, differential and battery.

Functions of Mechanical Parts

Objective

3.0 Given a list of mechanical parts and a list of functions, the learner will match the part with its function. The standard is 90%.

Objective Type

Remember category.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

Emphasis is on the general overall function of each part, and how the parts interact to make the car function properly.

Instance Specifications

| Engine Parts | Example of Function | Practice Remembering | Test |
|---|---|---|---|
| Piston | 1 | 1 | 1 |
| Alternator | 1 | 1 | 1 |
| Cylinder | 1 | 1 | 1 |
| Crankshaft | 1 | 1 | 1 |
| Flywheel | 1 | 1 | 1 |
| Transmission | 1 | 1 | 1 |
| Fanbelt | 1 | 1 | 1 |
| Drive shaft | 1 | 1 | 1 |
| Differential | 1 | 1 | 1 |
| Battery | 1 | 1 | 1 |

Testing

This objective will be tested by matching specific parts of an engine with their function.

## Gearing Mechanisms

### Objective

4.0 Given a short answer test, be able to answer questions on the function of gearing mechanisms and gear reduction. The standard is 90%.

### Objective Type

Remember principle.

### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

The main goal of this section is to communicate a general understanding of how the power from an engine is translated into propulsion. For example: how does a car engine turn the car wheels to move it down the street; or how does a boat engine spin the propeller blades to move it through the water? This section should also emphasize that the gearing mechanisms (in a car or boat) involves gear reduction translating energy from large to small gears and the calculation of gear reduction ratios (discussed in the math section). A detailed presentation of the drive shaft, differential, transmission, etc. is not necessary. The purpose of gearing systems and the ratio of small to large gears is sufficient.

### Instance Specifications

| Type of Gearing Questions | Example | Practice | Test |
|---|---|---|---|
| 1. General | 1 | 2 | 3 |
| 2. Specific with diagrams | 1 | 2 | 3 |

### Testing

This objective will be tested by short answers to questions concerning gearing mechanisms and gear reduction.

Turbines

Objective

5.0 The learner will briefly describe the operation of a turbine. Attributes required for full credit include:

a. a force coming in contact with blades
b. spinning action of blades
c. torque energy carried by turbine shaft

Objective Type

Remember principle.

Instructional Media/Method

Print and Lecture.

Strategy Specifications

The general concept of turbine operation should be emphasized. Concentrate on the three attributes specified in the objective. There should be at least two examples of the types of "force" coming in contact with the blades. In particular, steam (produced by nuclear power) should be used as an example of a force that spins the turbine blades.

Instance Specifications

| Turbine Operation | Example of Operation | Practice Remembering | Test |
|---|---|---|---|
| Force | 2 | 1 | 2 |
| Spinning blades | 2 | 1 | 2 |
| Torque energy from turbine shaft | 2 | 1 | 2 |

Testing

This objective will be tested by briefly describing the operation of a turbine. The description should include information on a) the force coming in contact with blades, b) spinning action of blades and c) the torque energy carried by the turbine shaft.

## Mechanical Relationships

### Objective

6.0 Given a list of mechanical parts, be able to identify which of the following categories they belong to: prime mover, drive or gearing system, propulsion system, or auxiliary.

### Objective Type

Category use unaided.

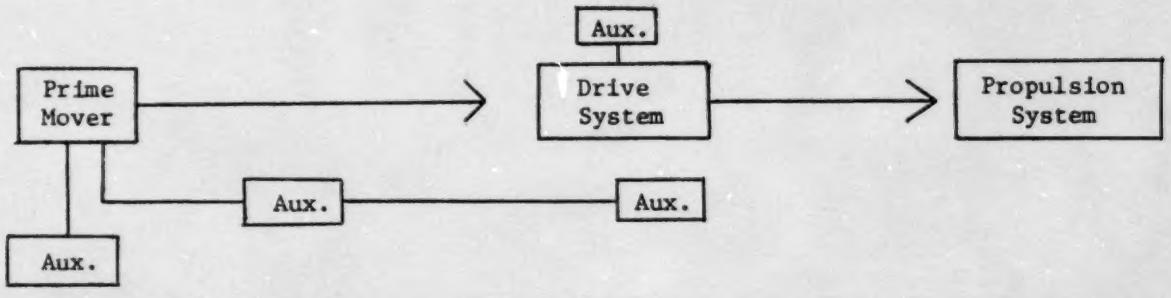
### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

The mechanical relationship among the various mechanical parts is the most important concept in the mechanical operations area. Mechanical parts and functions can be separated into four major categories: prime mover (e.g. gas, diesel, or turbine engines); drive or gearing system (e.g. drive shaft, gearing mechanisms, transmission); propulsion system (e.g. propeller blades, car wheels); and auxiliaries (e.g. generator, alternator, compressor) (see figure below). Detailed information about these areas is taught in the OT, STS, STG, and AW "A" schools. However, the way these areas are interrelated and function as a whole is not emphasized.

This segment should define the four categories and show how these broad areas organize the separate mechanical functions taught in objectives 2.0 and 3.0. Continue to use car (and boat) examples to illustrate the concept.




### Instance Specifications

| Categories | Example | Practice* | Test |
|---|---|---|---|
| 1. Prime Mover | 2 | 4 | 2 |
| 2. Drive System | 2 | 2 | 1 |
| 3. Propulsion System | 2 | 1 | 1 |
| 4. Auxiliaries | 2 | 4 | 2 |

*Students should generate items that would fall into each category.

### Testing

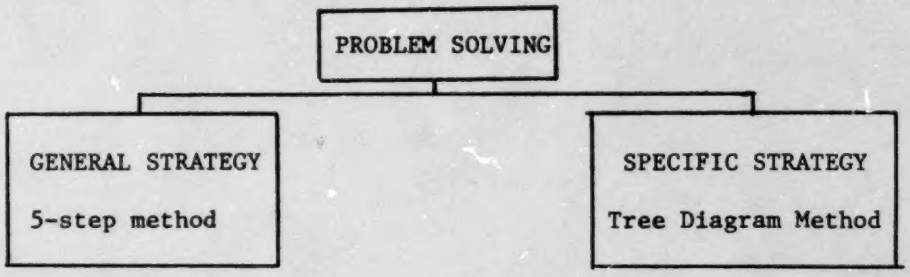
The objective will be tested by categorizing a list of mechanical parts into four categories: prime mover, drive or gearing system, propulsion system or auxiliaries.

## PROBLEM SOLVING

### Introduction

Problem solving is an area with which many people experience difficulty. The acoustic sensor operations communities indicated that problem solving was a necessary skill in the performance of acoustic analysis, and that it is not directly addressed in their respective "A" schools. The 5-step and tree diagram methods will give the students problem solving strategies to use in "A" school and on the job.

### Major Topic Areas



## Five-Step Method

### Objective

1.0 Given a set of verbal reasoning problems to solve, the learner will apply the five-step problem solving method (see Whimbey & Lockhead, 1980). This objective will be achieved when the learner solves 90 percent of the problems, and illustrates how he/she applied the five-step problem solving method.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

The steps involved in using the five-step problem solving method are:

1. Have a positive attitude.
2. Clearly understand the facts and relationships.
3. Work from beginning to end. Do not guess.
4. Break the problem into smaller manageable parts.
5. Active problem solving. For example you may decide to use mental pictures, self-talk, and/or diagrams to clarify the material.

Use military related examples and practice whenever possible.

### Instant Specifications

| Types of data | Example | Practice | Test |
|---|---|---|---|
| Five-step method | 3 | 4 | 3 |

### Testing

The objective will be tested by applying and illustrating the five-step problem solving method to a set of verbal reasoning problems and successfully solving 90 percent of them.

Problem-Solving Method

| Types of Data | Examples | | | | Practice | | | | Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 |
| Nature of problem | | | | | | | | | | | |
| 1. word | | X | | | | X | | | X | | |
| 2. sentence | X | | | | X | | | | | X | |
| 3. paragraph | | | X | | | | X | | | | X |
| 4. passage | | | | X | | | | X | | | |
| Additional information | | | | | | | | | | | |
| 1. break down | X | | | X | | X | | | | X | |
| 2. surround | X | X | | | X | | | X | | | X |
| 3. other source (i.e. instructors library) | | | X | | | | X | | X | | |
| Check and correct | | | | | | | | | | | |
| 1. does conclusion fit | X | X | | | | | X | X | X | | X |
| 2. if not repeat steps 1-3 | | | X | X | X | X | | | | X | |

A reading pre and posttest consisting of job related passages should be developed. Students will receive the pretest before reading comprehension instruction and the posttest after completing the instruction. (For more information on reading comprehension strategies see Drobrovolny, McCombs, and Judd, 1980.)

Testing

The objective will be tested by listing the rules associated with the questioning and the problem solving methods.

## Tree Diagram Method

### Objective

2.0 Given problems requiring progressive analysis, the learner will apply the decision tree problem solving strategy. The objective will be achieved when the learner illustrates how he/she applied the decision tree strategy for a minimum of three levels.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Print and Lecture.

### Strategy Specifications

The tree diagram method is a progressive deepening problem solving strategy. Binary decisions, such as yes-no or on-off, are made in a stick figure tree diagram. Branches of the tree are pursued until the problem is solved (Davis, 1974).

### Instance Specifications

| Types of Tree Diagram | Examples | Practice | Test |
|---|---|---|---|
| 1. Two branches (minimum 3 levels) | 1 | 2 | 2 |
| 2. Three branches (minimum 3 levels) | 1 | 2 | 2 |

### Testing

The objective will be tested by tree diagramming a problem to solution.

## Vigilance

### Objective

3.0 Given a forty minute vigilance task, the learner will participate in the task and then graph his/her vigilance performance.

### Objective Type

Rule use unaided.

### Instructional Media/Method

Lecture and Print.

### Strategy Specifications

Maintaining viligance during watch is an important job requirement for Acoustic Sensor Operators. Students should be informed about vigilance performance in general. For example, the rate of detection decreases substantially in the first 30 minutes of any vigilance task and then levels off. Students should also be provided with suggestions for maintaining alertness that they could implement on-the-job, such as, getting plenty of sleep the night before a watch period, taking advantage of all breaks, requesting the use of radio, or shifting their body position frequently. (For more information about vigilance see McGrath, Harabedian, and Buckner, 1959; Mayo 1979; and Bergum and Lehr, 1962a).

A forty minute vigilance task should be developed to expose the students to a vigilance experience. The vigilance task will also involve the students graphing their own performance to observe the decrement curve. The graph should be shared with the class to show the generality of vigilance performance decrement and individual differences.

### Instance Specifications

| Type of Vigilance Task | Example | Practice | Test |
|---|---|---|---|
| Visual Task | 1 | 0 | 1 |

### Testing

The objective will be tested by presenting the students with a forty minute vigilance task and having the students graph their performance.

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